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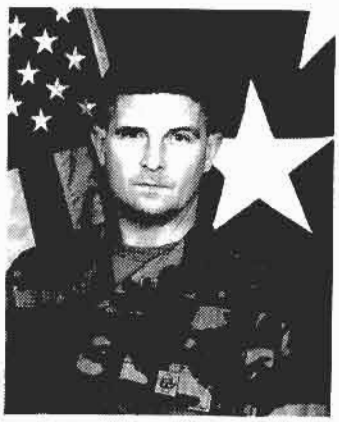
Perspective

The AMEDD...Continuing Support for the Warfighter



Major General Darrel R. Porr

The United States Armed Forces and their coalition partners have recently concluded the liberation of Iraq and the removal of Saddam Hussein and his regime during Operation Iraqi Freedom. The combined use of Special Operations Forces, precision-guided munitions, and superior armored forces resulted in a rapid defeat of a disorganized and poorly trained army. Despite the rapid military victory, there was great concern regarding the use of weapons of mass destruction; the hunt for them continues today. This conflict was notable for the limited casualties and a relatively small number of deaths among coalition forces. These casualties were highlighted by the intense media coverage that provided a regular tally of casualties on a daily basis.

In stark contrast, during the 4 years, from 1941 to 1945, that it took to defeat Germany and the other Axis powers, the number of U.S. casualties was enormous; there were approximately 500,000 deaths of U.S. servicemen throughout World War II. During World War II, the size of the Army Medical Department (AMEDD) was immense, with 45,000 physicians, 45,000 nurses, and nearly 100 million patients treated from 1943-1945 throughout two theaters of operation. The excellence of the AMEDD was then evidenced by the 97% survival rate of casualties who made it to a battalion aid station or other established medical treatment facility.

In this era of modern warfare where casualties are relatively few, the AMEDD must continue to modify its role in support of the warfighters. The great difficulty in planning for this conflict in Iraq was the real potential for overwhelming casualties due to weapons with nuclear, biological or chemical (NBC) agents. The deployed medical assets have easily dealt with conventional casualties due to rapid evacuation off the battlefield and out of the theater, if necessary. These medical capabilities, however, would be severely tasked to handle numerous NBC casualties. While our soldiers are well trained in dealing with NBC agents, the AMEDD must always be cognizant and prepared for the overwhelming potential of their devastating physical and psychological effects.

This issue of the AMEDD Journal contains a diversity of articles of interest to the AMEDD community:

- *Medical Support of the Sinai Multinational Force and Observers: An Update, 2001.* In this article, the author explains the medical support for the 11-nation coalition on the peacekeeping mission in the Sinai desert.

- *Stress Casualty Forecasting.* This article discusses the impact of physical and mental stress on the conduct of military operations and how to effectively plan for and prevent these types of casualties.

- *Medical Implications of High Altitude Combat.* The authors cite specific examples to describe some common types of illnesses due to altitude exposure, as well as how to diagnose and treat these conditions.

- *Improving Capital Investment Strategy.* A timely article that explores the options available for managing Defense Health Program dollars within the AMEDD to effectively plan for capital expenditures.

- *Mustering Out the Medics: AMEDD Downsizing After World War II.* Details the difficulties encountered by the AMEDD when confronted with the demobilizing of the AMEDD portion of the 7 million soldiers remaining in service after the surrender of Germany and Japan.

Medical Implications of High Altitude Combat

LTC (Ret) Lester W. Grau†
Dr William A. Jorgensen††

Introduction

The fact that a piece of land is inaccessible, uninhabitable, or of little practical value is no guarantee that nations will not fight over it. Long, bloody wars have been fought and are being fought for inhospitable mountain real estate located between 10,000 and 23,000 feet (3050 and 7015 meters) in elevation. Examples of such high altitude combat include the 1953 to 1974 Chinese invasion of Tibet and subsequent guerrilla war, the 1953 to 1958 Mau-Mau rebellion where British troops fought rebels in the Aberdares mountains of Kenya, the 1962 Sino-Indian War in the Himalayan mountains bordering Bhutan and Tibet, Soviet-Mujahideen combat in Afghanistan's Hindu Kush mountains from 1979 to 1989, the Peruvian government's clashes with *Sendero Luminoso* guerrillas in the Andes throughout the 1980s, and the Indo-Pakistan continuing conflict over the ownership of the Siachen glacier which began in April 1984. Recent (1999) Indo-Pakistani clashes in the Kargil area of disputed Kashmir again demonstrate that high altitude combat is often contemporary combat. Tens of thousands of combatants have perished in inhospitable ice, snow, and rock while battling for national prestige, water rights, survival, or geographic positioning. The U.S. Army has not had to fight at such altitudes, but with the war on terror, the possibility of U.S. military commitment to such areas is not all that remote. Operation Anaconda, in Afghanistan, is the highest altitude ground fight (10,500 feet) in U.S. history. Since the U.S. Army is still inexperienced fighting at these altitudes, it should draw from the experience of others. There are some distinct medical problems that medical personnel should plan for in the event of a high altitude contingency operation.

High Altitude Medical Considerations

The world's highest mountains are in the Himalayan and Karakoram mountain chains of Asia. The Himalayan Mount Everest towers at 29,028 feet (8,853.5 meters) whereas the highest point in the United States, Mount McKinley in Alaska, is 20,320 feet (6,197.6 meters). The highest point in the Colorado Rockies is Mount Elbert at 14,433 feet (4,402.1 meters). The highest point in the European Alps is Mont Blanc at 15,771 feet (4,810.2 meters).[1] Man is not naturally adapted to live and work at these high altitudes. Any time a person travels to an altitude of 8,000-10,000 feet (2440-3050 meters) or higher, the atmospheric changes in pressure and available oxygen cause physiological changes which attempt to ensure that the body gets enough oxygen.[2] These physiological changes are pronounced among mountain peoples, who have lived in the cold and higher altitudes for generations. Their bodies are short, squat, stocky and barrel-chested compared to those of lowlanders, and their hands and feet are stubby. Their hearts are bigger and their bodies contain 20% more red blood cells. Their red blood cells are larger than those of lowlanders. Their heart rate is slower and their capillaries are wider. The alveoli in their lungs are more adept at oxygen absorption. Many develop a fatty epithelial pouch around the eyes to counteract cataract and snow blindness.[3]

High altitudes are characterized by extreme cold, strong winds, "thin" air, intense solar and ultraviolet radiation, and rapidly changing weather including severe storms which can cut off contact for a week or longer. Personnel should be screened and acclimated before deploying to high altitudes since these conditions at high altitude are usually more dangerous than enemy fire. Medical personnel should prepare for the special demands of high altitude treatment and care. Bullet and fragment wounds, which normally are not serious, can quickly prove fatal at altitude. Movement in the high mountains often results in broken bones, severe lacerations and contusions, and internal injuries caused by falls and falling rock. Frostbite and hypothermia are a constant danger. Acute mountain sickness, high altitude pulmonary edema, and cerebral edema are frequently fatal consequences of working at high altitude. Mental and physical abilities decrease at high altitude and it also induces personality disorders. Sudden weight loss is often a problem. The rarefied atmosphere permits increased ultraviolet ray exposure which causes problems with sunburn and snow

blindness. High altitude shelter heating is often by unvented kerosene stoves, which means that personnel breathe air that is thick with soot. Medical personnel will be exposed to the same dangers of working in high altitudes and much of their normal medical equipment will not function, or function effectively, at high altitudes. For example, hospital generators and vehicles are often diesel-powered. Diesel engines lose efficiency at 10,000 feet (3050 meters) and eventually do not work at all due to the thinness of oxygen at higher elevations. Helicopters cannot haul heavy loads over 13,000 feet (3965 meters) as their rotors lack air dense enough to provide lift. Altitude requires additional animal or gasoline-fueled overland transport which adds to the physical demands and logistic requirements of medical support in this environment.

Screening and Acclimatization

At high altitude, there is less oxygen and atmospheric pressure. The soldiers selected for high altitude duty should be screened for their ability to function in this environment. Soldiers should be in excellent physical condition and have sound cardiopulmonary systems. Short, wiry soldiers are preferable to tall, over-muscled soldiers. Selected soldiers should possess a higher level of intelligence in order to allow them to readily adapt to the hostile environment.[4] Personnel who have had radial keratotomy corrective eye surgery should not go "to altitude" as their vision may permanently cloud. Personnel records should be screened for previous high altitude sickness. Some personnel can be administered acetazolamide (Diamox) prophylaxis, however, personnel with sulfa allergy or G6PD deficiency cannot use acetazolamide. Personnel with the sickle cell trait should be excluded since rapid exposure and dehydration could set them up for splenic syndrome. Further, certain medications (any benzodiazepine such as Valium) inhibit acclimatization and personnel using these should be carefully evaluated.[5]

All personnel should undergo an acclimatization program to accustom them to their new environment and to improve their cardiopulmonary systems. A physically fit soldier can adapt to the cold in about 3 weeks.[6] Experience further shows that the body normally adapts to a new altitude in about 2 weeks. During the acclimatization phase, the body accumulates additional red blood cells which help transport oxygen.[7] The Pakistani Army acclimates their personnel over a 7-week cycle. They begin with a 3-week stay at 10,000 feet (3050 meters), where personnel acclimate to the cold while they undergo daily physical conditioning and learn mountaineering, rock climbing, rope rappelling, and mountain survival. During the final 4 weeks, the soldiers learn advanced mountaineering techniques, trek to 14,000 feet (4270 meters), return and trek to 17,000 feet (5185 meters) and then return and finally trek to 19,135 feet (5836 meters).[8] Despite all training and efforts, acclimatization is not possible at altitudes over 18,000 feet (5418 meters), so personnel exposure at these altitudes must be limited and closely supervised.[9]

Medical personnel should advise logisticians and planners on special considerations for high altitude combat. For example, lightweight, pre-cooked, high-caloric, high-carbohydrate rations are essential and aid acclimatization. Supplementary candy and soups will help offset the inevitable loss of appetite at high altitude. Boiling snow for water requires fuel, so provisions have to be made to provide water or water purification equipment to the soldiers "at altitude" where dehydration is a constant threat. Noncommissioned officers need to "push water" to compensate for the diuresis of acclimatization. Troops working above 15,000 feet should be issued pressurized sleeping bags. These bags, which are inflated with a foot pump, have been tested to provide equivalent pressure of 8,370 feet (2550 meters) while at 13,600 feet (4150 meters).[10] Medical personnel should further recommend a rotation program where highest altitude exposure is limited to 10 to 14 day periods.

During the Soviet-Afghan War, Soviet physicians and physicians' assistants often accompanied small units on high altitude missions, since the patients required immediate medical care and evacuation took too long to save many patients.[11] Limited medical staffing in the U.S. Army will prevent many physicians and physician's assistants from accompanying the high altitude patrols. Therefore, the brunt of the responsibility for saving injured and sick soldiers will fall on the combat medic. In addition to the medic's normal skills, he will need to be trained in mountain rescue techniques, treatment of altitude-specific medical problems, and high altitude evacuation procedures. The medic should accompany the unit during acclimatization and rotate in and out of the high altitude area with the unit.

In an emergency, Diamox can be given to nonacclimated personnel (125 mg twice a day) starting the day before ascent and up to 2 days after ascent. However, this is an emergency measure that should only be used for a forced ascent to over 10,000 feet in 1 day. Normal acclimatization is preferable. There are side effects to Diamox, such as peripheral paresthesias and bone marrow suppression. The possibility of bone marrow suppression is relatively rare, but cannot be ignored.[12]

Frostbite

Frostbite is the most common injury at altitude. Frostbite is a continual danger, but especially following any exertion. Sweat rapidly freezes around the toes and fingers. Frostbite may be classified as frostnip, superficial frostbite, or deep frostbite, depending on the severity of the case. Frostnip usually occurs on the tips of the ears, nose, fingers, toes, and cheeks and is noticeable as a whitening of the skin. Simple warming of the area is usually sufficient treatment. If it advances to superficial frostbite, the affected areas will be firm and have a white waxy appearance. Warming and gentle massaging of the area are the necessary treatment. As the area rewarms, it may turn a mottled blue or purple and swell. Nerve damage may also accompany superficial frostbite. In case of deep frostbite, major areas of tissue are frozen and killed. The areas are cold, pale, solid, and hard. Infection and amputation often result. The patient must be evacuated. Medics should be cautioned that once the frozen area is thawed, do not allow it to refreeze and do not thaw unless continual warmth and litter evacuation are available. It may be necessary to prevent thawing in order for the injured soldier to walk out. Once thawing occurs, the severe pain prevents the patient from walking out, although codeine, aspirin, or morphine should help the patient.[13] Evacuation at altitude is often difficult. Weather or weight limitations may prevent helicopters from flying to the patient. Often, patients must be carried on stretchers to lower elevations where the helicopters can operate. Soviet experience fighting in the mountains of Afghanistan proved that 13 to 15 men might be involved in carrying out one patient. Exertion at altitude is difficult and the stretcher party had to provide its own security as well.[14]

Hypothermia

Hypothermia is the result of the body losing heat faster than it can be produced. The body's core temperature begins to decrease and the patient shivers violently, has trouble using his hands, and is generally clumsy. When the core temperature falls to 90°F - 95°F (32°C - 35°C), the patient becomes uncoordinated, has difficult speaking, and is disoriented and apathetic. As the core temperature continues to decrease, the patient becomes more irrational, lapses into semiconsciousness, and eventually unconsciousness with subsequent cardiac arrest. If the patient cannot be rewarmed on site, the patient needs to be evacuated. Medics should be equipped with the mountaineering hydraulic sarong – a rewarming device that wraps around the patient and circulates a warmed liquid around the patient's body using a camp stove or catalytic generator. "Hot oxygen" breathing units, which use a soda lime and CO_2 reaction to warm oxygen, can also aid in rewarming the body core.[15] When a hypothermia casualty's body core temperature drops below 90°, when he stops shivering, or when he passes out, extra care must be given to handling him or he may develop cardiac arrhythmia and sudden death.[16]

Falls and Climbing Injuries

Fractures, severe lacerations and contusions, or internal injuries often result from falls or falling rock injuries. The basic principles of trauma care should be followed. Medics should examine the patient for spinal injury as one of the first checks. Medics should not hesitate to put cervical collars on fall victims with suspected cervical spine injuries, particularly since these can usually be cleared in the field, avoiding unnecessary and hazardous evacuation.[17] Field splinting and immobilization should also be done before the patient is moved. The spleen, liver, and kidneys are the most likely organs to rupture and bleed internally from a fall. A torn diaphragm or intestine is also a possibility in falls and climbing injuries.[18]

Mountain Sickness, High Altitude Pulmonary Edema, and Cerebral Edema

Mountain sickness or altitude sickness normally begins as a headache that may be associated with insomnia, loss of appetite, vomiting, cough, shortness of breath, irregular breathing, tightness in the chest, loss of coordination, swelling around the eyes and face, general weakness, and reduction in urine output. The patient

will lose physical coordination and mental acuity and tire quickly after mild activity. Mountain sickness normally takes at least 24 hours to develop, but nonacclimated personnel often develop the symptoms within 6 to 12 hours if they are quickly transported to elevations at 11,475-14,750 feet (3500-4500 meters). Treatment involves awareness of potential problems, rest, sleep, and adequate nutrition. Should that fail, the patient should descend to a lower altitude for a few days rest until improvement.[19]

Moderate mountain sickness involves the same symptoms, but their intensity increases and urine output is often less. If a day of rest does not help the patient, he or she should be immediately transported to a lower altitude. Usually, an early descent means an early recovery.[20]

Severe mountain sickness occurs in about 2% -3% of mountain sickness cases and involves high altitude pulmonary edema or cerebral edema. Twenty percent of acute, severe mountain sickness cases are fatal. Signs and symptoms of high altitude pulmonary edema, the accumulation of fluid in the lungs, include persistent cough, gurgling chest sounds, red frothy sputum, breathlessness, and tachypnea and tachycardia. Younger soldiers (under age 25) and soldiers with a history of pneumonia or other respiratory illness are prone to high altitude pulmonary edema. The symptoms of cerebral edema include headache, difficulty in balance, loss of coordination, and labored breathing. Severe mountain sickness may prove fatal within a few hours. Proficient medics may administer nifedipine and dexamethsone and administer oxygen or use a Gammow bag (a pressurized bag).[21] The patient still needs to be transported to a lower altitude. Oxygen, Diamox, Tylenol, aspirin, codeine, Decadron, Valium, Lasix, Phenergan, or morphine have all been used to help the patient during descent.[22]

The best prevention of mountain sickness is a gradual ascent with plenty of fluids and food provided to the soldiers. Climbing soldiers need to avoid overexertion. The worst approach is to drive or fly the soldiers from low to high altitude and then require them to finish the ascent.[23]

"Siachen Syndrome"

The change in barometric pressure and reduced quantity of oxygen at high altitude leads to mental status changes as well as physiological and psychosomatic changes. The Pakistani Army has noted that for every rise in a thousand feet, a person's temperament may change. A good-natured soldier at 19,000 feet may become irrational and selfish at 20,000 feet, introverted at 21,000 feet and unhinged at 22,000.[24] Although not recognized as a disease, the so-called Siachen syndrome has been noted among veterans fighting on the Siachen glacier. Its symptoms include disorientation and various psychological disorders. The experience has resulted in psychiatric treatment for some of the veterans.[25] Team-building, discipline, and productive activity help prevent the apathy which leads to Siachen syndrome.[26]

Training the Medical Force for High Altitude

The Soviet Union had a special course to train physicians to function effectively at high altitude. The course was founded in 1987 – in the seventh year of the Soviet-Afghan War. The course was taught at the Kirghizistan medical institute with the usual medical courses and it prepared military and civilian physicians for mountain rescue and high altitude treatment duties. The course met twice monthly in 90-minute sessions. The course devoted 34 lecture hours and 74 hours of practical application to medical topics. Another 792 hours were devoted to mountaineering training, of which 47 were lecture and the remainder practical application.[27] Although it would be difficult to find the time to train U.S. military physicians to the same standard, the medical topics taught at the course may prove of value when planning a training course for medical personnel who may serve at high altitudes (See table on following page).

Medics training for high altitude combat will necessarily involve many of the same skills needed in mountain search and rescue units. Medics will have to know how to rig patients and litters for evacuation from precarious positions. The search and rescue community has a wealth of information that can be tapped for military medical use. Search and rescue personnel in the Yosemite National Park region developed a field medical kit for use by emergency medical treatment and technician personnel. It can be carried in a single medium-sized pack with an internal frame or carried by several members of the unit since the kit is divided into modules. This kit provides a starting point for planning a high altitude medic's kit.[29]

Topic	Lecture (hours)	Practical exercise
Introduction to goals, missions, and content of high altitude medicine. Special features of high altitude physiology. Acclimatization to high altitude: short- and long-term. Mountain pathology.	2	2
Acute mountain sickness: etiology, pathogenesis, clinical picture, treatment, and prevention. Pulmonary edema.	2	2
Effects of high altitude on the nervous system, heart vessels, excretory system, gastrointestinal tract, and circulatory system. Diagnosis, treatment, and prevention.	2	2
Peculiarities of the course of "normal" illnesses at high altitude.	2	2
Directing an acclimatization program. Personnel selection and prognosis of their health in the mountains. Medical oversight and preventive medical examinations.	2	2
Examination.	-	2
Special features of mountain trauma. First aid for accidents.	-	2
Diagnosis of trauma, broken bones of the extremities, methods of moving immobile patients.	2	4
Evacuating patients in the mountains.	-	4
Wounds, methods of stopping hemorrhage, bandaging.	2	6
Depression.	4	4
Traumatic shock, first aid for shock from mountain accidents, and trauma.	2	4
Emergency medical service and transport of patients with trauma to the head, spine, chest, stomach, and pelvis.	2	6
Special features of medical treatment for freezing, frostbite, and snow blindness.	2	-
Emergency medical service for drowning victims.	2	-
Examination.	-	2
Special aspects of organizing medical support for forces in the mountains.	2	-
Rigging medical gear for evacuation and treatment in the mountains.	2	2
Screening soldiers for service in the mountains.	2	4
Oxygen equipment and its use.	2	4
Training drills for high altitude treatment.	-	20
TOTAL	34	74

Combined Physician's Curriculum for Mountain Rescue and Combat[28]

Thinking Lofty Thoughts

The U.S. military is faced with a variety of challenges as it converts from a forward-deployed to an expeditionary force. Part of being an expeditionary force is planning and preparing for contingency missions in various regions. One possible contingency is deployment to a high altitude region. The U.S. Army active component and Army National Guard units that currently train in the mountains and Alaska are already aware of some of the problems involved in working at altitude and in the cold. They know that such a contingency mission would be difficult, but with proper foresight and preparation, medical personnel can meet the challenge and protect the force.

Diagnostic Module

Scissors
Blood pressure cuff
Stethoscope
Watch with sweep second hand
Penlight
Hemostat
Two thermometers (clinical and hypothermia)
Two pair tweezers
Three airways (adult, child, and pedi)
One syringe bulb
One 50 mL suction syringe and catheter

Intravenous Module

Two 1000 mL bags lactated Ringer's
One 500 mL bag 5% dextrose in water
Two Macro solution sets
One Pedi solution set
Two 20-gauge catheter needles
Two 18-gauge catheter needles
Two 16-gauge catheter needles
Two 14-gauge catheter needles
Two 19-gauge butterfly needles
Two 21-gauge butterfly needles
One roll 13 mm tape
Five gauze pads, 5x5 mm
10 Band Aids
10 alcohol swabs
Four towelettes
Three tourniquets

Trauma and Dressing Module

Two triangular bandages
Two Kerlix
Four Kling
Six Surgipads, 20x19 cm
Three rolls of tape
One Ace bandage
One Betadine scrub
Three swabs
Six towelettes
10 gauze pads, 10x10 mm
10 Band Aids
Two Steri-strips, 13x100 mm
Two Steri-strips, 6x75 mm
One pair bandage scissors
10 ammonia inhalants
One 25x75 cm large trauma dressing

Drug Module

Injectable: Two Meperidine HCL (Demerol) 100 mg
One Benadryl 50 mg
One Xylocaine (Lidocaine) 100 mg
Two Narlozone (Narcan) 0.4 mg
Two Epinephrine (adrenalin) 1:1000 1 mg
One Valium 10 mg
One 25 g Dextrose in 50 mL preloaded syringe
Two bicarbonate preload
Topical Neosporin ointment
Syringes & needles
Three 3 mL with needles
Two 1 mL with needles
Five alcohol swabs

Oral: 15 aspirin tablets
10 Second tablets, 100 mg
10 Dexadrine tablets, 5 mg
10 Codeine tablets
20 Salt tablets
20 Lomotil tablets
Syrup of Ipecac
Activated charcoal

Splints Module

Two full-leg air splints
One arm air splint
One ankle air splint
One wrist air splint
One wire ladder splint
One cervical collar
One towel for cervical collar
Trauma dressing

Oxygen Module

One D tank of oxygen
Oxygen mask and nasal cannula
Two oxygen bottles

Signal and Survival Module

Flare gun and three flares
Orange hand-held smoke flare
Signal mirror
Whistle
Compass
Knife
Matches
Pencil and pad
Yellow plastic tube tent
Two space blankets
Maps
Toilet paper

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Stress Casualty Forecasting

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Introduction

Stress casualties have had a significant impact on military operations from the first recorded battles.[1,2] The Bayeux Museum in France* reports that when King Harold of England was shot in the eye by an arrow, his followers were so traumatized that William the Conqueror's invaders from France had little trouble slaughtering the remaining fighting force. More recently, an Israeli tank battalion, caught in a night ambush by Syrian armor in the Lebanon incursion in 1983, suffered equal numbers of stress casualties and wounded casualties. Therefore, stress casualty forecasting is an important element of force planning. The formula presented in this article provides a tool to estimate these casualties across the military operations continuum for a 24-hour period. But, potentially more important than forecasting stress casualties is understanding the causes of stress casualties, and taking steps to mitigate these causes.

Methodology

Three areas impact on stress casualties. First is physical stress (PS). Second is mental stress (MS). The PS and MS measure the scenario's impact on the individual troop. Third is unit readiness (UR). The UR measures the leadership, training, and cohesion impact on the unit. In addition to these three areas, there is an operational impact (OI), a wounded in action (WIA) impact, and a chemical, biological, radiological, nuclear, high-yield explosive (CBRNE) impact.[3] All of these components are addressed in this article.

Physical Stress[4]

The PS assesses physiologic deprivations or exposures, which are known to decrease tolerance to psychological stress and contribute to stress casualties. Stressors include: (1) the soldier's cumulative days in active combat; (2) physical load; (3) dehydration; (4) sleep loss or disrupted sleep; (5) harsh weather exposure;

0.45	No PS: light duty, significant free time.
0.5	Low PS: routine duty, well-developed infrastructure.
0.6	Mild PS: austere environment, tent, and field showers.
0.9	Moderate PS: tactical environment, no amenities.
1.5	Severe PS: harsh climate, limited food and water, high operating tempo (OPTEMPO), no amenities.
2.5	Extreme PS: severe exposures and deprivations, intense OPTEMPO with very little sleep, no amenities, high rate of environmental and accidental injuries and diseases.

*The Bayeux Tapestry shows the Norman conquest of England at the battle of Hastings in 1066. It is a strip of linen, 230 feet by 20 inches in the Bayeux Museum, France. The slaughter depiction is very detailed. One of the authors, Mr Elliott, visited the museum several years ago and reports that it is an excellent display.

[1] For this article, the term stress includes stress reactions and psychiatric disorders. Under the Joint Medical Surveillance DNBI Report System, and in accordance with DODD 6490.5, the two categories are to be counted separately. The distinction is an important professional one; however, this article presents a general forecasting tool for rough estimate planning by general planners. It is not meant to be a rigorous scientific treatise solely for mental health professionals. Planners can expect psychiatric casualties to stay a low number no matter what the scenario, whereas stress reaction casualties can increase markedly.

[2] A stress casualty is a soldier held for treatment (HFT) in a medical treatment facility (MTF) over 24 hours, or past one duty day, diagnosed as having characteristics of a stress reaction or psychiatric disorder and receiving treatment for that condition. Casualties do not include: cases treated and released in 1 day, misconduct cases in disciplinary confinement, soldiers who surrender to the enemy because of stress, or delayed cases treated after redeployment from the operation. For this article, the MTFs include clearing companies, combat stress control units, and hospitals.

[3] In this context, high-yield explosive refers to weapons such as thermobaric, not conventional, munitions.

[4] See reference number 3 for further discussion of PS, MS, and UR.

(6) poor personal hygiene; (7) low-grade illnesses; and (8) malnutrition.

Mental Stress

The MS assesses mental or emotional stress. Stressors include: (1) anticipated level of danger to U.S. troops from the environment or enemy action; (2) seeing harm, suffering or injustice involving the local population, refugees or enemy prisoners of war, especially if requiring close contact with the bodies of victims; (3) lack of clarity and belief in the mission; (4) cultural friction with local populace or allies; (5) increasing time in the theater and uncertainty about the end date; (6) ambiguous forced choices in the mission or the rules of engagement; (7) mental workload, including boredom, overload, or intense vigilance; (8) crowding and loss of privacy or marked isolation; (9) inadequate mail, phone, and recreational opportunity; and (10) special events such as policy changes, holidays, or terrorist attacks.

0.3	Below baseline MS: for example, great faith in short mission, with little personal danger or exposure to non-U.S. personnel suffering.
0.5	Baseline MS: U.S. troops in ROK, circa 1994 (peacetime, including the demilitarized zone).
0.9	Mild MS: threat of personal risk or observed harm to non-U.S. personnel, but few confirmed events; increased generic deployment stressors but with fair to good faith in the mission.
1.2	Moderate MS: news or observations of harm to non-U.S. personnel, and higher threat to U.S. troops but with knowledge of few actual cases; further increased deployment stressors and workload issues; doubts about the mission.
1.5	Severe MS: observations of harm to U.S. personnel, severe sense of personal risk, no contact with home and no opportunity for recreation; but still fair to good faith in the mission and sense of an end point.
1.9	Extreme MS: high perceived risk of personal harm, observed extreme harm to U.S. comrades and noncombatants, low faith in mission, and no foreseeable end point.

Unit Readiness

The UR assesses: (1) unit cohesion; (2) leadership; (3) training; (4) combat experience; (5) personnel stability; (6) soldier quality; (7) ethical climate; (8) family stability; and (9) family preparedness. When positive, these issues are known to provide strong protections against soldiers becoming stress casualties. When negative, these issues can be strong contributing causes of stress breakdown. The standard for combat training in this model, for leaders and troops, is recent, successful force-on-force combat simulations, some in field conditions, and/or a large percentage of veterans of combat actions.

2.5	Highly combat-trained small unit with sense of "eliteness," and few recent changes of leaders or team members.
1.4	Highly combat-trained, larger rapid deployment unit with high unit identity, but with average turnover of leaders, troops, and attached supporting units, strong family-support network.
1.0	Well combat-trained unit with average unit identity, turnover of personnel and supporting units, and adequate family-support network.
0.8	Less combat-trained unit, average unit identity, average or more turnover of personnel or little training time together for teams to develop cohesion, undeveloped family-support network.
0.7	Poorly combat-trained or new unit, high turnover of personnel or very recent additions (fillers), poor trust in combat readiness, inadequate family-support network.
0.5	Untrained or demoralized unit with major known problems such as poor leadership climate and cohesion, much unresolved family or financial distress, or a unit undergoing hasty reorganization/reconstitution close to the enemy after taking heavy casualties.

Operational Impact

The OI stress is a constant of 0.00015 stress casualties times the population at risk (PAR).[5] This was the observed number of stress and psychiatric casualties that peacetime active duty U.S. Army troops in Korea had from 1992 through 1996. Korea was selected because it is a peacetime theater of approximately 30,000 troops that remained relatively stable during that time period. For most soldiers it is a 1-year tour, unaccompanied, which has many similarities to an overseas deployment to a noncombat peace support mission.

Wounded in Action

The WIA impact assesses the horror, personal fear or terror, grief, sense of helplessness, and perhaps loss of trust and anger at other U.S. personnel that troops may experience upon seeing their comrades wounded, or

[5]PAR refers only to military troops, not civilians.

knowing nearby units have suffered this. It was estimated that, after eliminating the impact of physical stress, mental stress, and unit readiness, for every 20 WIA hospital admissions there was one stress casualty.[6]

Stress Casualties

The following formulas show how the contributing components are combined.

OI = (0.00015 x Troop Population)

WIA Impact = (WIA Admissions/20) x ([PS+MS]/UR)

Validation of the Estimates

We tested the validity of our method by comparing forecasts to actual ratios. For a highly trained larger unit with high morale, taking significant casualties, the formula will give a ratio of WIA to stress casualties of approximately 10 to one. For an untrained or demoralized unit with major known problems, taking significant casualties, the formula will give a ratio of WIA to stress casualties of approximately two to one.

In World War II battles, the ratio usually ranged between 10 to one and three to one.[7] For one Marine division fighting on Okinawa, the ratio reached two-to-one.[8] An Army armored division attacking the German Gothic Line in North Italy experienced a two-to-one ratio.[9] Finally, in 1983, a ratio of one-to-one was reported in an Israeli tank battalion caught in a night ambush by Syrian armor in the Lebanon incursion.[10]

Example One[11]

Scenario. A mechanized infantry brigade of 4,000 troops will be in sustained defensive operations under harsh physical conditions in a hostile country. It is expected to sustain about 231 WIA hospital admissions per day. It has been in continuous defensive battle, withdrawing, for the past week, sustaining numerous casualties, getting little sleep, subject to rain and mud, and with problems with maintenance and resupply of food, water, and ammunition during that withdrawal. Many civilian refugees were killed in the past week, and more are likely to be used by the enemy as shields in their attack. The Brigade will internally reorganize and reconstitute units while in battle, replacing lost leaders and troops with replacements no one knows – some requisitioned from corps combat service support units. There is a high chemical threat but not expected use. The outcome is in serious doubt unless reinforcements arrive from the continental United States. The brigade chaplains and the officer and noncommissioned officer from the division mental health section, who are the only stress control assets, rate faith in the mission and morale as low.

ACE Settings. The terrain is "rolling foothills, mixed." The weather is "dry, overcast, temperate." The posture is "hasty defense." The brigade has a "slight combat power disadvantage." There is a good chance of "minor surprise"; however, the brigade has a "minor equipment advantage" over the opposition. The enemy has managed to "disrupt" the brigade's defensive front. All troops are wearing their body armor.

Number of Troops	4,000
WIA Hospital Admissions	231
PS Setting	2.5
MS Setting	1.9
UR Setting	0.5
OI Stress HFT	0.6
WIA Impact Stress HFT	101.6
Total Stress HFT	102.2

[6]While the formulae presented in this article, and the Army Casualty Estimator (ACE), do not show a lag, planners can expect a significant lag between WIA presentations and stress casualty presentations for any given incident.

[7]See reference number 1.

[8]See reference number 6.

[9]See reference number 2.

[10]See reference number 4.

[11]The ACE, available on the Internet at **https://ke.army.mil/synergy/main.php?cid=46**, can be used to do automated forecasting. In addition to stress casualties, ACE can provide forecasts for battle casualties, parachute operations casualties, and disease and nonbattle injuries.

Example Two

Scenario. A light infantry brigade with minimal armor augmentation but strong aviation support has just deployed to a friendly country that is under heavy terrorist attack from a fanatic minority aided by international terrorist and narco-terrorist organizations. The airport is secure, and light forces have deployed to conduct patrols to help the host government defend key infrastructure, mostly in urban (industrial and lower class residential) terrain. While U.S. equipment is far superior to the enemies', and our troops are highly trained for urban warfare, the rules of engagement have allowed the small cells of the enemy to make asymmetrical attacks (ambushes and command-detonated and suicide bombs) that have inflicted some U.S. casualties. These actions have also caused many innocent civilian casualties that are attracting worldwide media attention. Many of the civilian casualties are blamed on U.S. troops, although the civilians themselves mostly welcome U.S. assistance "at last." Unit chaplains and the one mental health officer and noncommissioned officer from the division mental health section rate U.S. morale as high and aggressive. They still honor the rules of engagement, although they are frustrated.

ACE Settings. The terrain is "urban." The weather is "wet, light, temperate." The posture is "offensive." The brigade holds a "major combat power advantage." There is a good chance of "minor surprise"; however, the brigade has a "major equipment advantage" over the opposition.

Number of Troops	4,000
WIA Hospital Admissions	28
PS Setting	0.9
MS Setting	1.2
UR Setting	1.4
OI Stress HFT	0.6
WIA Impact Stress HFT	2.1
Total Stress HFT	2.7

The enemy has a "disintegrated front" and the brigade can move at will. All troops are wearing their body armor.

Chemical, Biological, Radiological, Nuclear, High-Yield Explosive[12]

The CBRNE activity adds another dimension to combat. A troop requires additional sets of skills to operate in a CBRNE environment as compared to a conventional warfare environment. The troop seeing CBRNE WIA has a greater stress level, much of this due to the human senses not being able to detect CBRNE except through observing the WIA, and to the many ways agents can be delivered covertly. The CBRNE creates a fear of the unknown and the uncontrollable.[13] Historical experience in chemical warfare in World War I reported a common ratio of two stress casualties per one actual chemical injury in trained U.S. troops.[14] Panics also occurred when no actual agent was involved. This section accounts for the increased stress due to actual CBRNE activity. The training now refers to CBRNE training. You might consider a unit to be highly trained for conventional warfare, but that same unit might have to be considered only marginally trained for CBRNE warfare.

Physical Stress, CBRNE

The PS, CBRNE should not be set lower than the PS setting for conventional. It is assumed that Mission Oriented Protective Posture (MOPP) 3 or 4 has been declared. Troops are expected to have equipment and be wearing it. The MOPP, of course, increases the physical stress at all levels of activity.

0.7	Mild PS: austere environment, tent, and field showers.
1.1	Moderate PS: tactical environment, no amenities.
1.7	Severe PS: harsh climate, limited food and water, OPTEMPO, no amenities.
2.7	Extreme PS: severe exposures and deprivations, intense OPTEMPO with very little sleep, no amenities, high rate of environmental and accidental injuries and diseases.

[12]CBRNE is treated as one element in this article; however, it really is comprised of five elements. Each of these elements affects stress differently. Additionally, troops will have different training levels and equipment for each element. This model applies best to chemical agents and biological toxins. The authors have left it to future efforts for individual element forecasting.

[13]See reference number 7.

[14]See reference number 5.

Mental Stress, CBRNE

The MS, CBRNE should not be set lower than the MS setting for conventional.

1.0	Mild MS: threat of personal risk or observed harm to non-U.S. personnel, but few confirmed events; increased generic deployment stressors but with fair to good faith in the mission.
1.4	Moderate MS: news or observations of harm to non-U.S. personnel, and higher threat to U.S. troops but with knowledge of few actual cases; further increased deployment stressors and workload issues; doubts about the mission.
1.8	Severe MS: observations of harm to U.S. personnel, severe sense of personal risk, no contact with home and no opportunity for recreation; but still fair to good faith in the mission and sense of an end point.
2.4	Extreme MS: high perceived risk of personnel harm, observed extreme harm to U.S. comrades and noncombatants, low faith in mission, and no foreseeable end point.

Unit Readiness, CBRNE

The UR, CBRNE should not be set higher than the UR setting for conventional.

2.0	Highly combat-trained small unit with sense of "eliteness," and few recent changes of leaders or team members.
1.3	Highly combat-trained, larger rapid deployment unit with high unit identity, but with average turnover of leaders, troops, and attached supporting units, and strong family-support network.
1.0	Well combat-trained unit with average unit identity, turnover of personnel and supporting units, and adequate family-support network.
0.8	Less combat-trained unit, average unit identity, average or more turnover of personnel or little training time together for teams to develop cohesion, undeveloped family-support network.
0.6	Poorly combat-trained or new unit, high turnover of personnel or very recent additions (fillers), poor trust in combat readiness, inadequate family-support network.
0.4	Untrained or demoralized unit with major known problems such as poor leadership climate and cohesion, much unresolved family or financial distress, or a unit undergoing hasty reorganization/reconstitution close to the enemy after taking heavy casualties.

Operational Impact, CBRNE

The OI CBRNE stress is a constant of 0.000357 stress casualties times the PAR. This is in addition to the OI from conventional operations and reflects the increased stress, even during noncombat time, when troops expect and are on alert for CBRNE.

CBRNE Stress Casualties

When applying the CBRNE formulae, the WIA admissions are separated into two groups, WIA conventional and WIA CBRNE.[15] The two separate numbers are then run through their respective formulae.

The following formulae show how the contributing components are combined for CBRNE.

OI CBRNE = (0.000375 x Troop Population)

CBRNE Stress Impact = ([WIA Admissions / 5]) x ([PS, CBRNE + MS, CBRNE] / UR, CBRNE)

Example Three (See table on following page)

Scenario. The scenario for CBRNE is identical to example one, with one difference; most of the WIAs are due to CBRNE activity. There is now actual CBRNE use and significant numbers of WIA due to CBRNE activity are being admitted to hospital. Of the 231 WIA, 150 WIA or 65%, are due to CBRNE activity.[16] The planner can expect a significant increase in the number of stress casualties.

ACE Settings. The ACE settings remain the same as for example one, with the addition of settings for the CBRNE component.

Example Four (See table on following page)

Scenario. The scenario for CBRNE is identical to example two, with one difference; all of the 28 WIAs are due to CBRNE activity. The planner can expect a significant increase in the number of stress casualties.

ACE Settings. The ACE settings remain the same as for example two, with the addition of settings for the CBRNE component.

[15]This is an artificial separation of stress casualties for forecasting only. There is no clinical separation.

[16]This model does not estimate the percentage. The planner must estimate the percentage, or use hospital reports of actual admissions, and then enter the percentage.

Example Three (*ACE Settings* [con't])

Number of Troops	4,000
WIA Hospital Admissions	231
WIA conventional	81
WIA CBRNE	150
Percent Admissions due to CBRNE	65%
PS Setting	2.5
MS Setting	1.9
UR Setting	0.5
PS, CBRNE Setting	2.7
MS, CBRNE Setting	2.4
UR, CBRNE Setting	0.4
OI Stress HFT	0.6
OI Stress HFT, CBRNE	1.5
Stress HFT, conventional	35.6
Stress HFT, CBRNE	382.9
Total Stress HFT	420.6

Example Four (*ACE Settings* [con't])

Number of Troops	4,000
WIA Hospital Admissions	28
WIA conventional	0
WIA CBRNE	28
Percent Admissions due to CBRNE	100%
PS Setting	N/A
MS Setting	N/A
UR Setting	N/A
PS, CBRN Setting	1.1
MS, CBRNE Setting	1.4
UR CBRNE Setting	1.3
OI Stress HFT	0.6
OI Stress HFT, CBRNE	1.5
Stress HFT, conventional	0.0
Stress HFT, CBRNE	10.8
Total Stress HFT	12.9

Summary

Firm historical data, upon which to base mathematical forecasts where all factors are known and diagnoses are clear, are hard to come by; however, the formulas do seem to give reasonable estimates that could be useful for planning. It will help planners to understand the dynamics of the situation if they vary the settings and observe the impact on casualties.

This article has presented one approach to estimating stress casualties for all military situations. The intent is to present an easy-to-use estimating tool for planning, and help everyone have a better understanding of some of the complexities that lead to these types of casualties.

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Mustering Out the Medics: AMEDD Downsizing After WWII

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Between the time of the formal close of World War II (WWII) in Europe on 7 May 1945, and the end of 1946, the U.S. Army Medical Department (AMEDD) laid aside the burdens of war and assumed those of an uneasy peace in a stressful period of transition, which at least one historian has characterized as "The Great Unraveling." As the U.S. Army as a whole began the process of demobilization in earnest in the wake of the German and Japanese surrenders in the late summer of 1945, it found it increasingly difficult to sustain the capabilities of a medical component which was in itself an essential key to the success of that larger demobilization effort.[1]

As the Army turned to the task of fully demobilizing 7 million troops from a wartime peak strength of 8 million men, it tasked its shrinking Medical Department with solving problems which "seemed to press for an even quicker settlement than those of worldwide war itself." Both U.S. Army Chief of Staff George C. Marshall and Surgeon General Norman T. Kirk likely would have privately agreed with that anonymous scholar's later characterization of a "Great Unraveling," for the climax of the AMEDD's war lay behind them at Remagen and Shuri Ridge. Ahead lay the bleak prospect of lean budgets, declining resources, and global commitments.[2]

The AMEDD of late 1945 had much of which to be justifiably proud. During the war, a force of 45,000 Army physicians, a like number of nurses, and over 500,000 other specialists and enlisted personnel had sustained the fighting strength on every front. During 1943-45, the Medical Department had treated 9 million patients in its hospitals, another 2 million in quarters, and over 80 million cases were handled by the dispensaries as recipients of outpatient treatment. Despite the service's deployment to some of the most disease-ridden quadrants of the globe, the death rate from nonbattle causes during the climactic final 2 years of the war averaged only 3 per thousand per year, approximately equal to that of corresponding age groups in civilian life. If a wounded man survived to reach a battalion aid station or other medical facility, the odds for his continued survival were nearly 97% favorable. Nearly three out of every four soldiers were returned to duty after treatment. The rate of death from wounds was half of that recorded for American troops during WWI. No Army in the history of warfare had ever received finer medical support than that provided to the American forces during WWII.[3]

The coming of peace in Europe in the early spring of 1945 marked the immediate aftermath of the peak period for American casualties in all theaters of the global conflict, which crested at 81,000 per month in December 1944. The end of the fighting in Europe marked the close of mass casualty situations for those forces, but the then-impending invasion and conquest of the Japanese home islands were expected to produce a bloodbath. The AMEDD had to marshal its personnel and materiel resources to confront the challenges of both partial demobilization and the terrible losses anticipated to come from offensive operations in the Pacific Theater which were expected to continue into 1946.[4]

As early as June 1943, the Plans Coordination Branch of the Plans Division of the Operations Service, Office of The Surgeon General (OTSG), was tasked with planning for the reduction of medical operations as hostilities ceased. Renamed the Demobilization Branch and transferred to the Planning Division of the same service in February 1944, this organization was concerned not only with planning for reduction in personnel, but in facilities and supplies as well, while it also worked on medical procedures to be used in demobilizing nonmedical personnel. Since demobilization affected virtually every element of The Surgeon General's office, the Resources Analysis Division was given the added responsibility of coordinating all demobilization and redeployment planning and all matters pertaining to civil affairs.[5]

Headed by a civilian, Dr Eli Ginzburg, the Resources Analysis Division received the tasking for unified personnel planning for redeployment and allied planning

problems only 8 days before the German surrender. The division had authority to call upon any other elements of OTSG, including the Demobilization Branch, for assistance in these matters. Although some previous coordination had been made with the Army Special Service Forces headquarters to define basic principles, no adequate "logistical plan" for redeploying and reducing personnel had been worked out to cope with the "tremendous difficulty of which doctors and in what numbers you would be able to let out at what rate from which places," confessed Dr Ginzburg.[6]

The assembly of detailed data concerning the distribution and other aspects of medical personnel (age, efficiency, length of service, etc), the estimating of future personnel needs as medical operations declined and shifted geographically or in relation to the types of patient care required, and the periodic defining and refinement of criteria for discharge in the light of assembled data and estimates, became the function primarily of the Resources Analysis Division, and was closely related to its work in planning the reduction of hospital facilities. All of the planning emanating from OTSG had to mesh smoothly with the master redeployment and demobilization plans being drafted by the Army Service Forces, War Department, and National Resources Planning Board.[7]

The plans approved prior to the German capitulation envisioned a complex and leisurely process of demobilization and/or redeployment of American forces as the war in the Pacific continued. The War Department demobilization policy rested upon the guiding concept of fairness to all who had borne the burdens of service and battle. Aiming at a partial demobilization after the German surrender, the Army planned to discharge those among its enlisted personnel who had compiled a high Adjusted Service Rating, a numerical score which took into account each soldier's length of service, time overseas, combat experience, decorations, and number of dependents. Similar standards governed the selection of officers for discharge to the greatest extent possible.[8]

The AMEDD was thus expected to provide quality health care for all troops remaining on active duty on a global basis, while supporting the demobilization effort, confronting the problems of caring for both occupation troops and hordes of civilian refugees in war-shattered Europe, and preparing for the carnage yet to come in the Pacific, where out of the 767,000 troops earmarked for the planned invasion of Japan in early 1946, fully 268,000 were expected to become casualties. All of these responsibilities were to be met while the Medical Department simultaneously presided over its own partial demobilization. In many ways, the post-V-E Day mission was more daunting than those which it had confronted since 7 December 1941.[9]

The collapse of Nazi Germany found the Medical Department with approximately 35% of its strength serving in continental United States (CONUS), while the balance was deployed overseas. During the March-June 1945 period, a total of 185,000 patients had been evacuated from overseas to CONUS medical facilities. Each one was expected to require a further 5 to 6 months of care prior to discharge to civilian life or a VA hospital for further treatment. This meant that although only the Pacific Theater of Operations could be expected to generate another major influx of CONUS-bound casualties, there would be a sufficient number on hand to keep the general and convalescent hospitals operating at or near peak capacity until late autumn of 1945.[10]

The situation in Europe demanded the existence of a strong medical support system even after the fighting had ceased, for the normal health needs and peculiar afflictions of a restless veteran army engaged in occupation duty continued to furnish ample work for the medics. In January 1945, for example, the venereal disease infection rate had stood at 50 cases per each 1,000 troops in the European Theater of Operations. By the end of the year, it had soared to 250 cases per each 1,000 GIs as the bored and resentful troops flouted the nonfraternization regulations or sought carnal solace with the legion of desperate female displaced persons and refugees who willingly exchanged their favors for food and tobacco.[11]

Other troops fell victim to their own enthusiasm and poor judgment. The distillation of illicit liquors and their resultant consumption killed 31 soldiers within a single week in Germany. In July 1945, General George S. Patton reported that his third Army had lost 50 men killed and 500 wounded in shooting incidents which all too frequently stemmed from drinking bouts, as did many of the frequent road accidents. Patton himself would die as the result of an automobile accident within a few months of that time.[12]

The demobilization process, as fair as it was intended

to be, still imposed horrendous administrative burdens upon the units in Europe, and the resident medical units, which had to perform pre-discharge physical examinations on a steadily mounting number of troops as the weeks passed. Although the Japanese surrender on 2 September permitted a tremendous simplification of the problem of providing quality health care while expediting the demobilization process for all concerned, Surgeon General Kirk and his staff still faced a formidable task, which forced them to "reorganize, and indeed rethink, the basic structure and character of their organization." The department's leadership soon found that events were rapidly overtaking and rendering useless even the most recently conceived plans for a fair and rational demobilization process.[13]

In July 1945, Medical Department planners had anticipated that Medical Corps strength could be reduced only by some 7,000 officers over the next 10 months. On the same day that the first atomic weapon was detonated over Hiroshima, the department reaffirmed a policy that discounted a quick end to the Pacific war while failing to foresee the political firestorm which would erupt in Congress following the Japanese surrender, as servicemen-constituents petitioned their representatives to speed their demobilization. In the wake of Hiroshima and Nagasaki, immediate pressure fell upon the War Department to expedite the demobilization effort with all possible speed. The AMEDD's enlisted component began to melt away. Despite the formulation of an elaborate scheme for awarding points toward qualifying men for separation based upon a wide variety of factors, rapid changes in policy in response to Congressional protests reduced the entire discharge process to a muddle by late summer of 1945.

The resultant situation pleased no one. The point scores necessary for separation had been rapidly and repeatedly adjusted downward, but news of the changes did not always reach the necessary agencies in a uniform and timely manner. The situation became so chaotic that the chief of OTSG's Enlisted Branch learned of one such change only by reading it in a newspaper. Some separation centers were discharging men under one set of criteria while others followed entirely different standards. By whatever criteria, just under 5,000 AMEDD enlisted men had returned to civilian life by the end of 1945, and thereafter the flow of discharges became a flood.[14]

The demobilization effort took on a life of its own as it accrued both political and procedural momentum even before the Japanese surrender. By the end of 1945, fully half of the 8,300,000 men on active duty 7 months before had returned to private life, and by mid-1946, the Army's strength would be halved again. Well before the enlisted exodus had peaked, every Army doctor understandably anticipated that his own estimated date of discharge could be reasonably expected to advance by at least 5 months due to the Japanese collapse. When the pace of demobilization did not appear to be accelerating as expected, the Medical Department confronted serious morale problems among its physicians.[15]

The Lowest Ebb.

The majority of the service's wartime physicians were drawn from the 45,000 civilian practitioners who had been inducted for the duration in the months following Pearl Harbor. They had done a superb job throughout the war, but with the end of the fighting on all fronts, they wanted only to go home and resume their private medical careers. Three years later, a new Surgeon General looked back on the immediate period following the Japanese surrender and confessed that "the morale of the Medical Corps was at a low ebb on V-J Day. I refer to the manner in which Army Reserve, Army National Guard, and U.S. Army officers appraised their military experiences. They were dissatisfied; in fact, they were disgruntled . . . the extreme negativism of these civilian doctors, and it really was extreme, greatly complicated the postwar readjustment of the AMEDD."[16]

The restive physicians were not reluctant to inform anyone who would listen of their dissatisfaction with their prolonged retention on active duty. As the leaves changed on the trees lining the banks of the Potomac, the Surgeon General and his staff felt continued pressure from Congress, the public, the Adjutant General, and the War Department General Staff for the swift release of personnel. Facing an increasingly irascible officer corps and Congress, the Assistant Surgeon General, Brigadier General R.W. Bliss, assured a Senate subcommittee in October 1945 that "separations are now one of our important missions." He pointed out that the 7,213 doctors released from service since V-E Day represented about 16% of total Medical Corps strength, while total separations represented only 15% of the Army as a whole

to that date. General Bliss promised that every doctor except regulars, volunteers, and those with statutory duty obligations to fulfill would be returned to civilian life by the end of summer 1946. In the interim, he reminded the senators that the Medical Department still needed doctors to deal with a patient load of nearly 400,000 and the processing of nearly 1 million separations per month.[17]

General Bliss' assurances were ignored in some quarters. On 6 November 1945, Senator Clyde M. Reed of Kansas publicly charged that the AMEDD had retained more doctors on active duty by that September than it had on its rosters in January 1945, when a global war was still raging. The senator further criticized the service for what he termed was "an incredible degree of incompetency, inefficiency, and general neglect on the part of the OTSG of the Army, in dealing with the return of the doctors and surgeons from the Army service where they are not needed, to communities where the civilian need for proper medical attention is very great." Reed further called for the Secretary of War to conduct a formal investigation of the situation and take the necessary corrective action.[18]

Critics such as Reed were articulating genuinely felt grievances among the doctors still serving and their civilian constituents in many communities. The truth of the matter was not that the medical demobilization process was going badly, but rather that it was proceeding far more smoothly than had ever been anticipated prior to Japan's abrupt surrender. Over 11,000 physicians had been discharged by the time Senator Reed voiced his charges. What the public and many uniformed malcontents failed to realize was that, in addition to the medical skills still needed to provide definitive treatment in peacetime Army hospitals, an additional 2,000 doctors were required just to staff the separation centers then processing all troops for release. Even so, the ranks of the military surgeons were shrinking rapidly. By mid-November 1945, over 25% of them had been discharged, with separations running two months ahead of schedule in some cases. Fully 18,385 nurses out of a total of 57,000 had also been discharged by Thanksgiving. These separations were expedited by a declining patient load, which was expected to total no more than 220,000 by the end of 1945, and with only 70,000 estimated to require further treatment by mid-1947. This development allowed the department to schedule 25 hospitals for closure or transfer to the Veterans Administration by the start of 1946.[19]

Although the threat of a congressional or War Department investigation "did not change basic medical demobilization plans, it probably hastened the execution of them," observed the official historical account of the effort, for by the end of December, 22,000 doctors had been released from active duty. The period of September 1945 – March 1946 marked the peak phase of the medical demobilization effort; by the end of that time, 32,900 doctors had been released, along with nearly 10,000 dentists and 40,000 nurses. Within another 9 months, the ranks had been thinned by 45,000 doctors, 14,000 dentists, and over 50,000 nurses as 1946 closed with the AMEDD reduced to a pale shadow of its wartime strength. July of that first full postwar year had seen the department struggling to provide care with a force of only 8,500 doctors, 3,500 dentists, and 9,000 nurses. "Although the demobilization of critical category personnel, including shipment from overseas theaters, was an outstanding achievement," stressed the official account of the process, "it was undoubtedly too rapid from the standpoint of good medical care."[20]

Recessional.

The AMEDD of 1946-47 was an organization beset by crisis. Fortunately, the foresight of Surgeon General Kirk, and his successor, Major General Bliss, permitted it to seize upon this span of stressful transition as an opportunity for fresh beginnings as "reform and reorganization were to make the postwar years a major formative period in the history of Army medicine." The unknowing first steps in the process which would result in the saving of tens of thousands of lives during the chaotic early phases of the Korean War were taken even before the guns had fallen silent in Berlin and Okinawa.[21]

As World War II entered its final stages, it became clear to the Medical Department's leadership that the problems confronting the reduced force in the postwar period "necessitated fundamental reform. Superficial solutions would not suffice. The necessary first step was to redefine the objectives of the Medical Department; the second, to secure the means of realizing these objectives." Three primary objectives were quickly identified: the creation and maintenance of quality medical care, both in its preventive and therapeutic aspects; maximum possible coordination among the several sub-elements of the Army charged with providing medical service so that a high level

of service could be performed in the most efficient manner possible; and finally, the broadening of the scope of the Medical Department's work so that it fully encompassed the total field of medicine.[22]

The Surgeon General and his staff judged that the key component in accomplishing all of these aims was professionalism, for only a Medical Corps in which the members could grow professionally would be able to furnish a quality medical service for the Army. The opportunity for such growth was also the only means by which the AMEDD could hope to attract and retain the skills of able young physicians. The core of the professional program adopted by the department in the post-1945 period lay in the provision of multiple opportunities for postgraduate training.[23]

Beneath this laudable drive for increased professionalism and expanded opportunities for training lay the stark fact that the AMEDD was virtually destined for extinction by the late 1940s. It had to convince Congress to reinstitute conscription of physicians, or succeed in attracting adequate numbers of long-serving doctors of satisfactory quality to flesh out the ranks of the post-demobilization Medical Corps.

In the wake of demobilization, the AMEDD was left dependent upon a small cadre of 7,700 doctors, of whom only 1,206 were regulars out of an authorized strength of 3,000. Most of the Medical Corps slots were by then filled with graduates of the wartime Army Specialized Training Program (ASTP), which had sponsored the medical education of service-obligated physicians between 1942 and 1946. The ASTP graduates willingly (or unwillingly) came to form the bulk of the Medical Corps in the immediate postwar period. Called "the most disgruntled lot of doctors ever encountered by the Army," these men constituted "the main, indeed almost the only sure, source of replacements for the doctors who had left the Army." By mid-1947, it was estimated that the ASTPs would by early 1948 constitute the majority of the 5,000 Medical Corps doctors then on duty, and as a consequence, the Medical Department would be crippled without their continuing services. The last of the total of 13,373 physicians generated by the ASTP effort could be expected to complete their periods of obligated service and depart the Army, leaving the AMEDD unable to function by May 1950, if the prevailing trends continued to that time.[24]

The story of the postwar drive to both attract a sustaining force of high-quality physicians and further professionalize the AMEDD lies beyond the scope of this article. Although it marked the onset of a seminal wave of reform in the organization which had a profoundly positive impact upon its future, it was not enough to halt the flight of physicians from active duty. By 1948, the department still confronted a dire shortage of some 1,200 medical officers. Demobilization had truly marked the Army's loss and the civilian medical profession's incalculable gain of men who had been tried and proven under the most demanding conditions imaginable. As the AMEDD's leadership wrestled with the challenges of peacetime military medicine in a period dominated by an economy-minded Congress and a complacent citizenry, blind fate was once again rattling the dice in the cup and preparing to cast them into the bleak valleys of the Korean Peninsula.

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Improving Capital Investment Strategy

MAJ David R. Gibson, MSC, USA†

Introduction

The Army Medical Department (AMEDD) receives approximately one-third of appropriated Defense Health Program dollars. With an annual budget of approximately $6.5 billion, AMEDD expenditures are comparable to that of a large-cap stock. Standard and Poors currently defines large-cap stocks as publicly traded companies with a market capitalization over $3 billion.[1] Considering the magnitude of these expenditures, it is of little surprise that the AMEDD is often referred to as "The AMEDD Corporation." Although there are many arguments to debate the AMEDD's differentiation from that of a corporation, tremendous opportunity exists for the application of the best business practices found in the private sector. One of the more notable initiatives was LTG James B. Peake's (the Army Surgeon General) adoption of the Balanced Scorecard. The Balanced Scorecard is a strategy-based system that translates strategy into operational objectives and measures from four different perspectives: the financial perspective, the customer perspective, the process perspective, and the infrastructure perspective. Emphasis on improved business practices includes increased financial scrutiny of investment decisions.

A cursory review of Army facilities reveals one undeniable fact – they are getting older. There are only a few ways to turn back the clock on the existing inventory. This may be done in the form of capital investments for the purpose of regulatory/code compliance, system upgrades, complete replacement, or to improve business practices. Although many services and systems can be contracted, contracting in itself is not a panacea for aging health care systems and facilities.

Like corporate America, the Department of Defense and the AMEDD must ensure the most effective use of resources. Therefore, those who make decisions for government facilities must measure capital investments to ensure best business practices are used in an environment of increasingly scarce resources. Millions of dollars are spent on capital improvements at every installation and usually as a result of varying decision criteria. The purpose of this article is to identify capital investment analysis tools that can be used to analyze and prioritize projects from the financial perspective. These tools should be used in order to measure the financial merit of projects and provide decision makers a measure to consider when programming capital investments. Although this article addresses the use of these tools with construction projects, the methodology can be applied on virtually any project. Furthermore, the article includes sample output of an excel-based model that can be used by anyone who can answer questions about the size and costs associated with a given project.

Before discussing the tools, it helps to understand why they are used. In corporate America, businesses function with the intent of maintaining profitability. Capital investments are often required to start and sustain the business. Funding for these investments comes from sources such as long-term debt, short-term debt, earnings retained by the company, or by new capital raised through issuance of stocks or bonds. Regardless of the source of funds used, there is always a cost of capital. Capital investments should generate returns that meet or exceed the organization's cost of capital if the business desires to remain profitable. The higher a project's return on investment (ROI), the higher it should be rated from the financial standpoint. Although financial feasibility is generally a fundamental screening criterion for a project, the financial aspects should not be the only criteria used when considering projects. This is the methodology behind sound business investment.

Government resources are limited and sound business practices must be considered when identifying expenditures and capital investments of an organization; this concept is nothing new. What may be new is the idea that despite government entities being nonprofit organizations, they should still subscribe to a capital investment methodology that considers the government's cost of capital. The Office of Management and Budget (OMB) Circular A-94 was written to provide members of the Federal Government guidance on making well-

informed cost-benefit and cost-effectiveness analysis decisions.[2] Appendix C to OMB Circular A-94 is published yearly and provides both nominal and real discount rates to use when conducting these analyses. These rates represent the Federal Government's "cost of capital."

Obviously, some projects will be better investments than others. The challenge is to identify the appropriate decision criteria in order to determine how projects should be rated. Generally speaking, the higher the ROI the higher the priority. Although this sounds like a simple concept, this concept gets more complex when we consider how Army medical treatment facilities (MTF's) fund and operate their maintenance, repair, and construction programs. The MTF's are funded yearly with operations and maintenance (O&M) dollars that are used for maintenance operations, regulatory compliance projects, and business enhancement projects. The intent is to maintain facilities at a level that meets or exceeds regulatory and code compliance. Facilities measure their status by dividing the cost required to bring the facility up to current regulatory and code compliance by the cost to replace the facility. This computation produces the facility condition index (FCI). Army MTF's aim to achieve a FCI of .05 or less.

Briefly describing the FCI shows that facilities are forced to balance regulatory and code compliance with improving business practices as well as mission changes. To make matters more tenuous, funding is always scarce; projects are approved at different funding levels by different approval authorities; and projects are developed differently depending on the nature, size, and scope of the project. Regardless of the size, scope, or nature of the project, financial feasibility and funding options must always be considered. Moreover, a sound maintenance program must be in place in order for the facility's capital investment strategy to be successful. The maintenance program should be past crisis (or reactive) maintenance and well into preventative, and preferably predictive, maintenance. This will mitigate the risk of diverting funds for crisis response and allow Facility Managers and Commanders the ability to follow through with their planned O&M program. Although some projects and/or programs are pursued for other than financially sound considerations, mission (or regulatory compliance) requirements alone should not excuse decision makers from considering the financial merit of planned expenditures. Project approval is based on funding requirements and may require this analysis to be conducted at each, lower level as well as the corporate level. For example, projects requiring $25K or less can be approved by the local MTF commander. Projects requiring up to $300K are ranked at the local MTF and sent forward to the Regional Facility Director. Projects greater than $300K and less than $750K are prioritized and funded at the MEDCOM level. Projects with over $750K of new work must be approved by Congress as part of the Military Construction Program.[3]

To determine the ROI or financial feasibility of a project, there are a number of tools that can be used. These tools can be used separately or together and include: net present value (NPV), the internal rate of return (IRR), profitability index (PI), and payback (PB). Using NPV, IRR, PI and/or PB computations in conjunction with the FCI provides program managers the tools they need to rank order projects from the financial perspective. The OMB Circular A-94 states, "the standard criterion for deciding whether a government program can be justified on economic principles is net present value."[4] See Table 1 for computation of these measures.

Tools for Analyzing Projects

- NPV= $\sum_{t=1} \frac{NCF_t}{(1+k)^t}$ - NINV = PV inflows-PV outflows
- IRR = $\sum_{t=1} \frac{NCF_t}{(1+r)^t}$ = NINV or the "r" that makes NINV= 0
- PI = $\frac{\sum_{t=1} NCF_t/(1+k)^t}{NINV}$ or GPV/NINV
- PB = $\frac{NINV}{\text{Annual Cash Inflows}}$

Table 1. Gross present value (GPV) is the present value of all the cash flows. When the net initial investment (NINV) is subtracted, you have a NPV.
NINV is defined as the net initial investment = (purchase price + installation cost + delivery fees) + any increase in working capital required (or increase in labor, maintenance contracts or staffing). Net cash flow (NCF) is defined as the net yearly cash inflows or yearly net cost avoidance. K is defined as cost of capital.

For nonprofit organizations, cash flows used in these models are typically identified through cost avoidance. Whether public or private, the concept is the same. It is a matter of identifying the cash flows in and out, then discounting them at the appropriate rate. Table 2 shows an example of project ratings based on these tools. Table 2 also demonstrates that the decision maker must determine the importance of the criteria. For example, two of the three criteria demonstrate that project one is the best investment. However, if the building is programmed for replacement in 6 years, the decision maker may decide to select project two over the projects that were ranked first and second (projects three and one respectively). The bottom line is that decision makers should understand how to measure projects and clearly identify the appropriate criteria for their capital investment decisions.

Project	NINV	NPV	PI	PB	Rank
1	200,000	20,000	1.10	7	2
2	500,000	41,000	1.082	6	3
3	275,000	60,000	1.218	10	1
4	150,000	5,000	1.033	7	6
5	250,000	20,000	1.080	7	4 (tie)
6	100,000	4,000	1.040	8	5
7	275,000	20,000	1.080	9	4 (tie)

Table 2. Reflects a financial analysis and ranking of seven projects. The table shows how a decision maker's criteria can change project rankings. Project number three offers the largest NPV, however, the PB is the longest of the projects ranked. If the decision maker's time horizon was limited to 6 years (for example, for facility decommission, replacement, etc), then project number two offers a better investment than project numbers 3 and 1.

The results of an excel-based spreadsheet model are shown immediately following this article. The data is the model's output and shows the resulting GPV, NPV, IRR, and PI for a sample project. Furthermore, the model shows that if you can merely answer the questions and fill in the cells, you can have the output data needed to measure the project's financial feasibility. This printout provides decision makers the financial information they need to determine a project's financial merit and therefore, a measure to use when comparing it to other projects.

Conclusion

Federal Government programs and projects can and should be analyzed for their financial feasibility. The OMB Circular A-94 (with Appendix C) provides the guidance and discount rates that government agencies should use for cost-benefit and cost-effectiveness analysis. The MTF facility managers and Commanders can use these tools to compute and compare the financial merit of projects. The results of the analysis can be used in conjunction with other decision criteria to ensure best business practices are integrated to produce sound capital investment strategies.

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1. Market capitalization is defined as the market price per share of stock multiplied by the number of shares outstanding.

2. OMB Circular A-94. October 29, 1992.

3. See DA PAM 420-11 for project definition and work classification.

4. OMB Circular A-94. October 29, 1992; p 3.

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Spreadsheet Model and Sample Output

Methodology:

The model is designed to analyze capital investment projects. The questionnaire is designed to accommodate Energy Savings Performance Contracts. The NPV of a project is determined by discounting net cash flows (or net savings) generated from a capital investment and subtracting the net initial investment. A present value of the net cash flows is determined by discounting cash flows at the weighted average cost of capital or, in the case of the public sector, the nominal or real interest rate. OMB Circular A-94 provides guidance on which rate to use (nominal versus real) based on the type of project. The interest rates can be found in Appendix C and should match the time frame of the project's duration. Appendix C is updated annually based on the most recent forecasts with available economic data. The nominal interest rate is generally the market interest rate (used for lease purchase analysis). The real interest rate is adjusted to remove expected or actual inflation (used for cost-effectiveness analysis).

Internal rate of return:

This is the "portfolio" return on the net investment as they relate to the net cash flows. For projects that require no initial investment on behalf of the government, this rate may be so high as to result in an error message for the cells showing IRR results.

Other tools for analyzing projects:

Four tools used for analyzing capital investments are shown below. The use of one or a combination of these tools depends on the specific nature of the project. Therefore, the use of additional models may be necessary to make sound corporate decisions when conducting financial analysis and comparing projects.

Tools for Analyzing Projects

- Net Present Value (NPV)= $\sum_{t} \frac{NCF_t}{(1+k)^t}$ - NINV = PV inflows-PV outflows
- Internal Rate of Return (IRR) = $\sum_{t} \frac{NCF_t}{(1+r)^t}$ = NINV or the "r" that makes NINV = 0
- Profitability Index (PI) = $\frac{\sum_{t} NCF_t/(1+k)^t}{NINV}$ or GPV/NINV
- Payback (PB) = $\frac{NINV}{\text{Annual Cash Inflows}}$

Please send all questions or comments on the model to david.r.gibson@us.army.mil

Capital Investment Analysis

Notes: Project Title Chiller Replacement
Location Blank Army Hospital
Date of Analysis 9/27/2002

Please answer the following questions:

1. What is the total current working estimate (CWE) of the project?	275,000
2. What amount of the CWE will be funded by the government?	275,000
3. What is the total amount of transition fees (not including equipment)?	0
4. What is the total amount of initial outfitting?	0
5. What is the total annual amount of additional management fees required?	0
6. What is the total increase in annual maintenance fees associated with the project?	0
7. What are the fees required for developing the requirement ?	2,000
8. What is the appropriate interest rate? If the project is an EUL, enter nominal the interest rate. If doing a CB analysis, enter the real interest rate. OMB Circular A-94, Appendix C for current nominal and real rates.	3.90%
The project's NINV is ⟶	**277,000.00**

9. What is the gross yearly cost savings to be realized by doing this project (by year)? This should include savings from a decrease in the maintenance contract. Enter 0 for years when contract is expired.

Yr 1	50,000	Yr 16	50,000	Yr 31	-
Yr 2	50,000	Yr 17	50,000	Yr 32	-
Yr 3	50,000	Yr 18	50,000	Yr 33	-
Yr 4	50,000	Yr 19	50,000	Yr 34	-
Yr 5	50,000	Yr 20	50,000	Yr 35	-
Yr 6	50,000	Yr 21	50,000	Yr 36	-
Yr 7	50,000	Yr 22	50,000	Yr 37	-
Yr 8	50,000	Yr 23	50,000	Yr 38	-
Yr 9	50,000	Yr 24	50,000	Yr 39	-
Yr 10	50,000	Yr 25	-	Yr 40	-
Yr 11	50,000	Yr 26	-	Yr 41	-
Yr 12	50,000	Yr 27	-	Yr 42	-
Yr 13	50,000	Yr 28	-	Yr 43	-
Yr 14	50,000	Yr 29	-	Yr 44	-
Yr 15	50,000	Yr 30	-	Yr 45	-

Project Cash Flow Results

Year	GPV	NPV	IRR	NINV (277,000.00) PI
1	$48,123.20	($228,876.80)	#NUM!	0.174
2	$98,047.26	($178,952.74)	#NUM!	0.354
3	$148,044.30	($128,955.70)	-25%	0.534
4	$198,044.18	($78,955.82)	-12%	0.715
5	$248,044.17	($28,955.83)	-3%	0.895
6	$298,044.17	$21,044.17	2%	1.076
7	$348,044.17	$71,044.17	6%	1.256
8	$398,044.17	$121,044.17	9%	1.437
9	$448,044.17	$171,044.17	11%	1.617
10	$498,044.17	$221,044.17	12%	1.798
11	$548,044.17	$271,044.17	14%	1.978
12	$598,044.17	$321,044.17	14%	2.159
13	$648,044.17	$371,044.17	15%	2.340
14	$698,044.17	$421,044.17	16%	2.520
15	$748,044.17	$471,044.17	16%	2.701
16	$798,044.17	$521,044.17	16%	2.881
17	$848,044.17	$571,044.17	17%	3.062
18	$898,044.17	$621,044.17	17%	3.242
19	$948,044.17	$671,044.17	17%	3.423
20	$998,044.17	$721,044.17	17%	3.603
21	$1,048,044.17	$771,044.17	17%	3.784
22	$1,098,044.17	$821,044.17	18%	3.964
23	$1,148,044.17	$871,044.17	18%	4.145
24	$1,198,044.17	$921,044.17	18%	4.325
25	$1,198,044.17	$921,044.17	18%	4.325
26	$1,198,044.17	$921,044.17	18%	4.325
27	$1,198,044.17	$921,044.17	18%	4.325
28	$1,198,044.17	$921,044.17	18%	4.325
29	$1,198,044.17	$921,044.17	18%	4.325
30	$1,198,044.17	$921,044.17	18%	4.325
31	$1,198,044.17	$921,044.17	18%	4.325
32	$1,198,044.17	$921,044.17	18%	4.325
33	$1,198,044.17	$921,044.17	18%	4.325
34	$1,198,044.17	$921,044.17	18%	4.325
35	$1,198,044.17	$921,044.17	18%	4.325
36	$1,198,044.17	$921,044.17	18%	4.325
37	$1,198,044.17	$921,044.17	18%	4.325
38	$1,198,044.17	$921,044.17	18%	4.325
39	$1,198,044.17	$921,044.17	18%	4.325
40	$1,198,044.17	$921,044.17	18%	4.325
41	$1,198,044.17	$921,044.17	18%	4.325
42	$1,198,044.17	$921,044.17	18%	4.325
43	$1,198,044.17	$921,044.17	18%	4.325
44	$1,198,044.17	$921,044.17	18%	4.325
45	$1,248,044.17	$971,044.17	18%	4.506

Current Working Estimate-	275,000
Expected rate of inflation-	4%
Number of years project delayed-	3
Future Project Cost-	309,338

The printout shows the project breaks even or has a payback of a little over 5 years and can now be measured against other projects. The cells at the bottom show the impact of the project cost if delayed for 3 years.

Medical Support of the Sinai Multinational Force and Observers: An Update, 2001

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The Multinational Force and Observers is an 11-nation coalition force with the mission of peacekeeping in the Sinai. It commenced operations in 1982 and continues today after two decades of successful enforcement of the 1979 Egyptian-Israeli Treaty of Peace. The fielding of a medical support team for this mission was the first effort of its kind for the U.S. Army Medical Department, resulting in a uniquely organized medical unit. A U.S. Army physician heads the medical team, which includes nine other physicians from six different countries. The team provides health care for the 2,500-person coalition in the remote Sinai desert. This writing compares earlier medical support with that of August 2000 through July 2001 and describes medical conditions and problems encountered during the 12-month tour of duty. This article updates two previous articles on the subject published in Military Medicine in 1983 and 1991.

Introduction

Because the United Nations could not provide the peacekeeping force called for in the 1979 Egyptian-Israeli Treaty of Peace, the two governments agreed upon a protocol, establishing an 11-nation coalition, the Multinational Force and Observers (MFO). In 1982, after Israel withdrew its forces from the Sinai Peninsula and returned the territory to Egyptian sovereignty, the MFO began its treaty verification and mediation duties.

The treaty divides the Sinai Peninsula into four zones, A through D (Fig. 1), and limits the number of military personnel and vehicles in each zone. Zones A through C are in Egypt; zone D is a 4-kilometer strip along the border in Israel. The mission of the MFO is to observe, report, and verify violations of the specific limits on military forces deployed in each zone. The MFO carries out its mission with three light infantry battalions manning approximately 30 remote sites (observation posts and checkpoints) in zone C, a 400-km x 25- to 50-km strip of Egypt along the Israeli border. MFO civilian observers perform the mission in zones A, B, and D using motor vehicles and aircraft. The MFO Coastal Patrol Unit extends the mission to the sea, and ensures freedom of navigation through the Strait of Tiran.

The 11 nations of the MFO contribute in varying ways. Colombia, Fiji, and the United States each provide one light infantry battalion. The United States also provides force-level staff officers and a support battalion consisting of headquarters, aviation (rotary wing, UH-l), supply, and transportation, medical companies, and an explosive ordinance disposal detachment. Hungary staffs the military police unit, the Italian Navy forms the Coastal Patrol Unit, and the French Air Force adds a fixed wing detachment with a DHC-6 Twin Otter and crew. Uruguay furnishes an engineer and transportation unit, including heavy equipment operators, and Australia, Canada, New Zealand, and Norway fill out the remainder of the support staff. A Lieutenant General (currently a Canadian) serves as the Force Commander in the Sinai, whereas a civilian Director General supervises the organization from the headquarters in Rome.

Although initially planned to last for 10 years, the organization has persisted for two decades. Some strategists and senior U.S. leaders question the need for the MFO as it exists today, arguing that the support role could be readily contracted out and much of the force reduced using satellite imagery and electronic monitoring.[1,2] This, however, would require amendment to the treaty and would remove the international human presence that has fostered trust and goodwill between the signatories. The growing unrest in the region certainly underscores the need for an international presence.

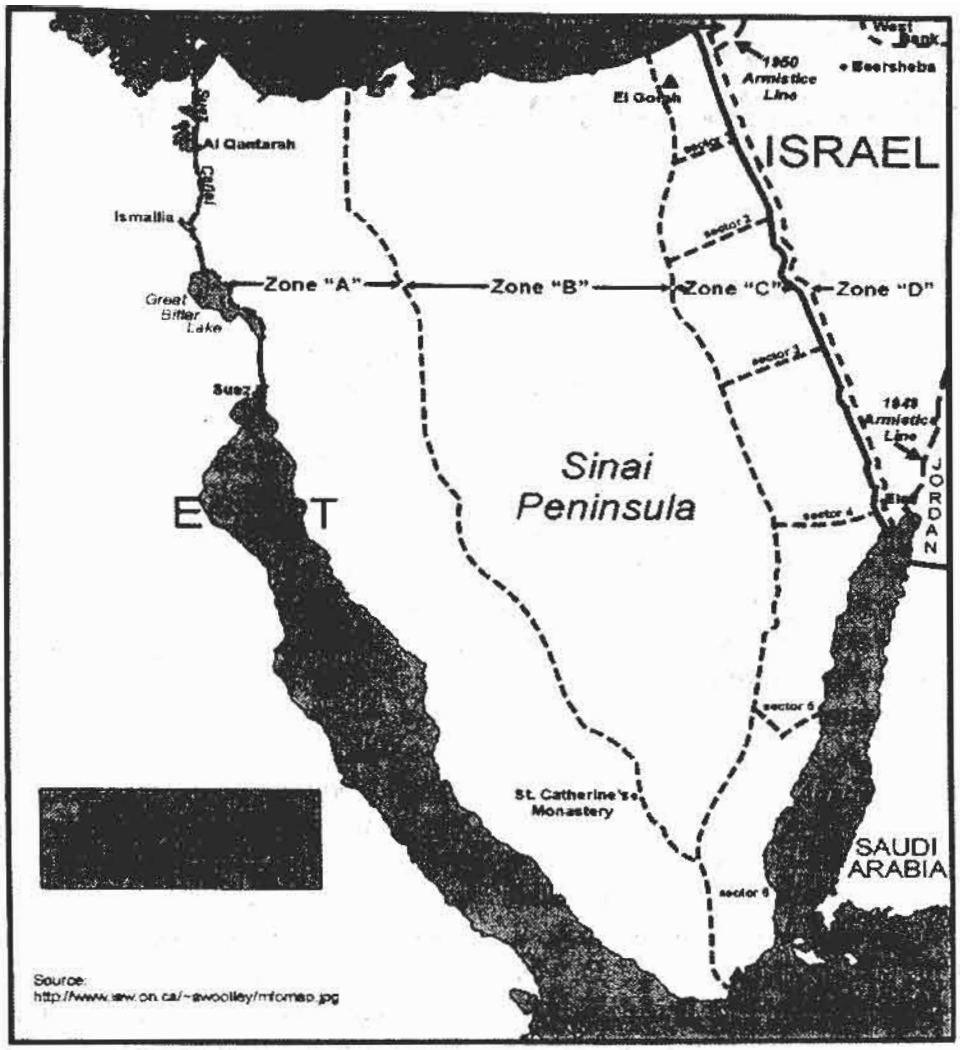

Fig. 1. Map of the zones of the 1979 Peace Treaty, Sinai Peninsula, Egypt.

Two previous articles describing the medical operations of the MFO were published in the October 1983 and the October 1991 issues of *Military Medicine*.[3,4] This article describes the medical challenges and experiences of the medical team from August 2000 through July 2001, highlighting changes from previous experiences.

Medical Organization

Health care in the MFO is based out of two clinics, one each at the North and South Camps at El Gorah and Sharm el Sheikh, respectively. Organic assets provide a broad range of support services for the MFO, including primary care, dental service, mental health, physical therapy, preventive medicine, veterinary support, medical logistics, and evacuation to high quality tertiary care centers. Ground ambulances are based at six of the seven sector control centers, one checkpoint near a particularly hazardous canyon road segment and at each of the clinics. A U.S. Army aviation company equipped with UH-IH helicopters provides air evacuation service. If needed, the French Air Force DHC-6 Twin Otter can assist with longer evacuations. The two clinics each have a three-bed, 72-hour holding capability with one licensed practical nurse assigned to each. Patients needing urgent surgical or other specialty consultation can be evacuated to tertiary care facilities in Israel, a 30-minute helicopter flight from North Camp or a 70-minute flight from South Camp. Air evacuation cannot proceed until approval is gained from the Egyptian and Israeli military liaisons (a 30- to 60-minute process).

Fortunately, evacuations out of sector were uncommon, averaging one to two per month. Most of the approximately 400 patients seen each month were minor illnesses, athletic injuries, physical therapy, or dental visits. Occasional motor vehicle accidents, appendicitis cases, or kidney stones occurred, as expected with any healthy population. Notably, the infectious disease rate was low, which was attributed to the medical team's preventive medicine efforts, ensuring clean water, safe food, and insect vector control.

The MFO health care team is a unique organization, including 10 physicians from 6 different countries, 4 dentists from 3 countries, and a variety of U.S. Army Medical Department officers and enlisted personnel (Fig. 2). The U.S. has primary responsibility for staffing the clinics and is supplemented by physicians from Fiji, Colombia, Uruguay, Hungary, and Italy and by dentists from Fiji and Colombia. Changes to the medical team's composition have been relatively small since 1982; the number of physicians and dentists has remained constant, and the number of enlisted personnel has changed minimally. The total authorized strength of the U.S. medical company remained at 63. The force surgeon position was raised to the force-level staff, whereas the rest of the U.S. medical staff remained assigned to the 1st Support Battalion. This allowed him the greater latitude and voice of the higher echelon and freed him of the administrative requirements of command. The most noteworthy personnel change was the replacement of the U.S. Army Nurse Corps officer with a physical therapy officer. The physical therapist proved to be a vital team member as sports and training injuries were one of the most common reasons for clinic visits in the MFO. Rehabilitation of all types of injuries averaged a monthly workload of 114 patients.

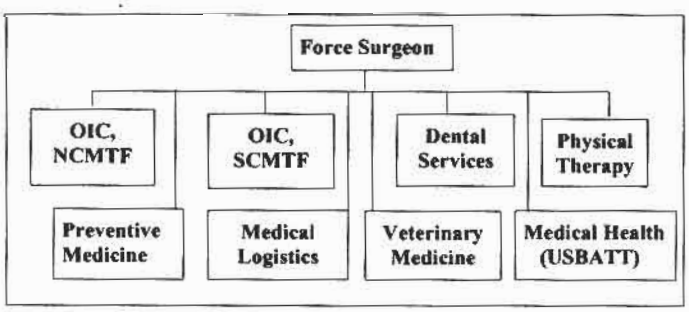

Fig 2. Technical medical supervision of MFO health care team. OIC, officer in charge; NCMTF, North Camp Medical Treatment Facility; SCMTF, South Camp Medical Treatment Facility; USBATT, U.S. Army Infantry Battalion.

Medical Planning and Operations

Over two decades of experience and continuing emphasis on reducing expenditures and personnel guide MFO medical planning. The MFO budget has declined from an initial $250 million in 1982, to $60 million in 1990, and to $25 million in 2001. Much of the early budget was for infrastructure; the continued budget reductions have affected all aspects of MFO operations. The medical budget accounts for a larger percentage of the total budget today; $355 thousand was directed for this purpose in fiscal year (FY) 2001.

MFO medical logistics has undergone some significant changes. The FY 2001 medical budget included $267,900 for expendable supplies through the U.S. Army supply system in Germany (up from $200,000 in FY 1991) and $34,600 for expendable supplies through the local economy (up from $20,000 in FY 1991). Although price inflation can account for these increases, the fact that these amounts have remained stable despite overall budgetary reductions indicates a greater reliance on MFO organic medical assets. Recent years' data confirm this, showing a reduction in the number of outside referrals and a corresponding increase in the patient load at the two clinics.

To reduce medical logistics expenditures, several improvements were made during the year. Eliminating rarely used nonemergency pharmaceuticals reduced warehouse and pharmacy inventories. Medications not in stock were obtained at a comparable (or slightly higher) price through local purchase in Israel, usually within 24 hours. Additional savings were realized by requiring force surgeon approval for the use of certain expensive medications or those frequently prescribed inappropriately by general practitioners (such as bupropion, nicotine patches, loratadine, fexofenadine, cetirizine, sumatriptan, omeperazole, itraconazole, and sertralirie).

The Medical Logistics office was also able to acquire over $150,000.00 worth of medical supplies and equipment at no cost to the MFO. The office constantly monitored the U.S. Army Medical Materiel Agency's excess stocks and placed requests for "free issue" medical equipment. Items received at no cost to the MFO included laboratory equipment, vehicle first aid kits (one per vehicle), microscopes, striker saws, sterilizers, examination

floor lights, and numerous pharmaceuticals. The savings created by maximizing the "free issue" allowed the purchase of other necessary medical items such as vital signs monitors and physician pagers, thus increasing the ability to provide a higher quality of care for MFO personnel.

The force surgeon made preventive medicine a priority. Except for one recently established outpost near the Gaza Strip (having only sandbags and a tent), the housing and sanitation facilities in the MFO were adequate although aging. The base camps, built by the Israelis during their occupation of the Sinai, had deteriorating plumbing and equipment. Nevertheless, running water was available at the base camps and the remote sites (although not always potable), and diesel generators provided electricity for lights, air conditioners, refrigerators, etc. Concrete, brick, or prefabricated metal buildings housed the soldiers. The medical team instructed and frequently inspected troops stationed at the outposts (who were responsible for their own food preparation and field sanitation) in proper food handling, water quality monitoring, and pest control techniques.

At the two base camps, the sanitation of the dining facilities had gradually deteriorated over the years, so improvements became necessary. The dining facility staff was trained on the standards set forth in the new draft *Technical Bulletin* Medical *530, Food Service Sanitation* (obtained from the U.S. Army Center for Health Promotion and Preventive Medicine). The draft manual encourages the use of heat-sensitive tape that changes color upon reaching the desired temperature. The MFO medical team procured this tape and used it to monitor the performance of the aging dishwashing machines at the two dining facilities. The tape identified inadequate functioning on numerous occasions, requiring temporary use of paper plates until the problem was corrected. Medical screening of the food service workers (local Egyptian nationals and British expatriates) and strict enforcement of hygienic practices (including the requirement for all workers to shower and change into a clean uniform each morning upon arrival) helped maintain sanitary conditions in the dining facilities.

Local Egyptian nationals perform many roles on both base camps, including food service workers, fire fighters, janitors, barbers, etc. The food service workers and barbers undergo semiannual physical examinations at the clinics with emphasis on screening for tuberculosis, hepatitis, diarrheal disease, and intestinal parasites. Three cases of *Hymenolepsis nana* infection were detected on routine stool screening of food service workers; these workers were excluded from work until treated and three negative stool samples obtained. The MFO medical team revised the food service worker tuberculosis-screening program to eliminate annual skin testing and focus on detecting those with active disease. Tuberculosis infection is common in Egypt, and the widespread use of bacillus Calmette-Guerin vaccine further complicates the screening process.

Comprehensive water testing of all MFO water sources was accomplished with the help of the U.S. Army Center for Health Promotion and Preventive Medicine-Europe. The potable water source at South Camp is a reverse osmosis unit (supplemented by bottled water), while the drinking water at North Camp comes from an Egyptian commercial bottled water supplier (except for the dining facility, which used water trucked from an Israeli water point). The Preventive Medicine section monitored the water quality weekly, measuring four variables: pH, free available chlorine, coliforms, and total dissolved solids. One episode of four positive coliform tests on the South Camp reverse osmosis system was investigated and found to have been most likely due to laboratory error. A new polyvinyl chloride pipe water distribution system was installed at South Camp, allowing greater use of the reverse osmosis system. This reduced the need for bottled water and allowed for significant cost savings. As of July 2001, the MFO had not yet realized these savings because of the troops' resistance to weaning off the more convenient and palatable bottled water.

Vector control was also of particular importance in the Sinai because West Nile fever, Sindbis, sandfly fever, and leishmaniasis were endemic to the region. Significant improvement in insect vector control resulted from the purchase of electrical insecticide (pyrethroid) heater-vaporizers for individual sleeping quarters. This became necessary because the indoor mosquitoes were not affected by the outdoor fogging (using permethrin-based insecticide). The use of larvacide in sewage lagoons contributed to the effort. A cooperative research effort with the U.S. Naval Medical Research Unit-Three (NAMRU-3) revealed no serological conversions (for West Nile fever, Sindbis, and sandfly fever) among febrile and afebrile

volunteer MFO soldiers stationed in the southern sector. This was especially noteworthy because an earlier U.S. NAMRU-3 study, in 1993-1994, showed 34% and 43% seroconversion rates for West Nile and sandfly fever, respectively, among MFO troops deployed in this sector (G. Chapman: personal communication). The continued presence of the West Nile virus was confirmed by the 2000 and 2001 West Nile fever epidemics in Israel, which received much public attention, and caused 417 human cases and 35 deaths from August through October 2000.[5,6] West Nile fever has been recognized in Egypt since the 1950s, and random blood testing showed that up to 22% of Egyptian children and 61% of Egyptian adults had antibodies.[7]

Medical Training Activities

Emphasis on medical training is critically important in the MFO, since medics arrive from the contributing nations with a wide range of training backgrounds. Many of the Fijian and Colombian medics were infantrymen with no medical training who were randomly selected for the task. During the year, the medical team developed both English and Spanish versions of a week-long basic first responder course and provided it to all Colombian and Fijian medics soon upon their arrival in the Sinai. To maintain the medics' skills, the force surgeon adopted a policy whereby all medics received 1 week of refresher medical training for each 6 months in the Sinai. Emergency medical technician-paramedic (EMT-P) instruction provided the primary sustainment training for U.S. medics, who needed EMT-P certification for the new "91W" military occupational specialty designation. Quarterly mass casualty (MASCAL) exercises culminated the preparatory "walk-through" MASCAL training. Subsequent focused follow-up training corrected deficiencies noted during the MASCAL exercises. The Israeli Defense Force permitted two MFO physicians to observe a large MASCAL at a major medical center in Israel, providing additional ideas for improvement of the MFO' own MASCAL exercises.

Medical Experiences, 2000-2001

During the year in the Sinai, the MFO health care team encountered a wide variety of medical, surgical, psychiatric, and trauma cases. Food-, water-, and vector-borne infectious disease were relatively uncommon, a likely result of the team's preventive medicine efforts. Most patients had routine problems such as sports injuries, upper respiratory infections, low back pain, overuse injuries, etc. However, occasional exotic cases such as malaria (imported), leishmaniasis, and perilymph fistula kept the work interesting (Table I).

Table I
MEDICAL EVACUATIONS AND UNUSUAL DIAGNOSES IN THE MFO, 2000-2001

Diagnosis/Etiology	No. of Cases	No. Evacuated by Air
Blunt trauma attributable to MVA	6	2
Appendicitis	4	2
Acute gout	3	
Urinary stones	3	
Malaria (imported from Colombia)	3	
Severe epididymitis (rule out torsion)	2	1
Leishmaniasis (unconfirmed)	2	
Acute psychotic episode	2	
Herpetic keratitis	2	
Near drowning	1	1
Closed head injury (attributable to fall)	1	1
Hip dislocation (fall from height)	1	
Suicide attempt (drug overdose)	1	1
Ectopic pregnancy, ruptured	1	1
Ectopic pregnancy, nonruptured	1	
Small bowel obstruction	1	1
Cholesystitis	1	
Osteomyelitis	1	
Mastoiditis	1	
Corneal laceration	1	
Spontaneous pneumothorax	1	
Perilymph fistula	1	
Paraphimosis	1	

In order of frequency. MVA, Motor vehicle accident. MFO average population = 2,456.

Although heat stress proved challenging, with daily highs near 50°C (115°F) in the summer in the southern sector, a proactive heat injury prevention program succeeded in preventing any serious heat casualties. MFO medics measured wet bulb globe temperatures at the base camps and at each remote site, and base camp medics reported the heat category to the Force Operations Center

every hour during times of heat stress. Command emphasis on adequate hydration and the use of work/rest cycles helped reduce the risk of heat injury.

Traveler's diarrhea was relatively common, usually occurring in association with meals from the local economy, especially from Cairo. More severe or febrile gastroenteritis occurred less frequently; treatment with ciprofloxacin for these cases achieved a rapid resolution.

One outbreak of *Shigella sonnei* enteritis occurred, involving 22 cases over a 12-day period at South Camp. The epidemiological investigation revealed that the cases occurred over several incubation periods, ruling out a point source and indicating a continuing common exposure and/or person-to-person transmission. The pattern of cases and the high infectivity of *Shigella* suggest that many of the cases were likely exposed through person-to-person contact. The drinking water system remained free of contamination during the increased scrutiny of the investigation and was not implicated. Although the investigation did not implicate a specific food or water source of infection (or whether the source was on or off camp), closer scrutiny of dining facility sanitation, field food service procedures, and personal hygiene produced significant improvements in force health protection. Among these improvements were the placement of a hand washing facility at a dining facility entrance without one, a Plexiglas cover for the salad bar (to help maintain sub–40°F temperatures and to limit contamination), and a requirement for a food handlers course for all leaders and unit barbecue coordinators.

The medical team saw many common ailments including athletic injuries, upper respiratory infections, dermatitis, and urinary tract infections. Skin infections were common, including cellulitis, impetigo, and skin abscesses. Conjunctivitis and pingueculae were common due to the dry, dusty, windy, and brightly sunlit conditions. Sexually transmitted diseases were seen in three to four persons per month and included chlamydia, gonorrhea, and condyloma acuminatum. No cases of human immunodeficiency virus were detected during the year in the routine screening program.

Table I depicts the year's unusual cases and those requiring evacuation by air or ground. Ten of these cases required urgent aeromedical evacuation. The two most urgent patients seen during the year were a near drowning case with respiratory arrest (with alcohol intoxication) and a ruptured ectopic pregnancy with severe internal bleeding (systolic blood pressure was 80 mm Hg and the hospital was 70 minutes away by helicopter). Other urgent or interesting conditions included four appendicitis cases, a case of mastoiditis (postsurgical; should not have deployed), a corneal laceration (soldier was playing with surgical tubing), a small bowel obstruction attributable to severe adhesions ("cacooning"), and a perilymph fistula in a breath-hold diver. Two cases of suspected cutaneous leishmaniasis occurred in U.S. soldiers in the southern sector, and three cases of malaria contracted in Colombia were diagnosed in soldiers from that country.

Twenty-four soldiers were repatriated for medical reasons during the year (Table II). Orthopedic and psychiatric diagnoses predominated. The initially high rate of repatriations (three to four per month) was primarily because of soldiers deploying with chronic medical conditions or pre-existing injuries. Most of these soldiers were from the United States and should have been identified during predeployment screening. The problem was resolved through communication with major de-

Table II
CAUSES FOR MEDICAL REPATRIATION IN THE MFO, 2000-2001

Diagnosis/Etiology	No. of Cases
Orthopedic diagnoses	9
Psychiatric diagnoses	6
Pregnancy, intrauterine	3
Mastoiditis	1
Severe headaches with abnormal computed tomography	1
Persistent dental pain	1
Persistent systemic allergic reaction	1
Sarcoidosis	1
Herpetic keratitis with corneal scarring	1

Orthopedic diagnoses included five knee injuries, three shoulder injuries, and a complication from a previous ankle surgery (with a protruding screw). Four of the nine orthopedic diagnoses were exacerbations of pre-existing diagnoses. Psychiatric diagnoses ranged from adjustment disorder with disturbance of emotion and conduct to acute psychotic episode. Other cases included poor impulse control with homicidal ideation, antisocial personality with homicidal ideation, depression with psychotic features, and dysthymia with suicide attempt. MFO average population = 2,456.

ployment centers in the United States; medical repatriations fell to less than one per month. However, an epidemic of knee injuries in the last quarter of the year resulted in a return to the original rate of about three per month.

These knee injuries were caused or exacerbated by training events. Twice each year, the MFO conducts a force-wide "skill at arms" competition, which includes contests of marksmanship, driving, vehicle identification, and a timed obstacle course, among others. Although the competition itself produced few injuries other than some mild cases of dehydration, the pre-event training proved to be more dangerous. Lower extremity injuries were common in the weeks preceding the competition, including one hip dislocation and various knee injuries. Another training event, the expert infantryman badge test was conducted during each 6-month rotation of the U.S. infantry battalion; the pretest training for the expert infantryman badge also contributed significantly to the number of knee injuries diagnosed.

Throughout the year, outbreaks of violence between Israelis and Palestinians became more frequent and more deadly. This required planning for MFO casualties outside of the usual area of operations. Greater force protection measures were also required for patients referred to Israeli medical centers. The primary impact on the MFO medical operation was delayed referral to tertiary care facilities because of border closures or rerouting to alternate border crossing locations. Special order medications purchased in Israel were occasionally delayed in transit. The reduction of open areas for off-duty MFO travel left more soldiers on camp during weekends and holidays, leaving them to rely on alcohol for entertainment. This, in turn, resulted in an increase in alcohol-related injuries and a corresponding decrease in the amount of sleep had by the physician on duty.

Summary

This article reviewed the medical operations and experiences of the MFO health care team during the period from August 2000 through July 2001. It showed how this unique organization has continued to evolve with new challenges such as reduced funding, deteriorating infrastructure, and heightened regional tensions. After two decades of service, the MFO continues to offer a professionally fulfilling medical experience to the personnel assigned to the health care team. The team is a unique organization providing international health care across an armed border to an 11-nation coalition deployed in a remote desert environment.

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AMEDD DATELINE

Wayne R. Austerman, PhD†

12 Apr — As the Civil War entered its second year, one out of every 12 Union soldiers was reported to be suffering from a venereal disease. During the war, each regimental surgeon was issued a copy of Dr Freeman J. Bumstead's 640-page textbook on the treatment of venereal diseases. The text offered such helpful advice as the injunction to avoid "dancing or horseback riding with lewd women." **(1862)**

17 Apr — Private Sylvester W. Matson was with a detachment of the 3d Infantry and 1st U.S. Dragoons on patrol near Fort Webster, NM, when the troops flushed a grizzly bear from the brush. "A citizen doctor, a contract surgeon, who was with our party rode out and was the first to shoot at the grizzly," he recorded in his journal. "This only angered the animal, which started on a rush towards our party. Several of the soldiers took deliberate aim at him and fired. The bear fell over and we finally dispatched him after a fierce fight. He was an immense animal. We had to cut up and distribute his meat on several pack animals. We feasted for several days on his flesh, which was excellent food." **(1852)**

22 Apr — Former AMEDD contract surgeon, Leonard Wood, was sworn in as U.S. Army Chief of Staff. **(1910)**

6 May — Mortally wounded at the battle of Chancellorsville, LTC Edmund Kirby received a deathbed promotion by order of President Lincoln, which jumped him from the rank of first lieutenant to that of brigadier general. **(1863)**

18 May — A detachment of the 1st U.S. Dragoons engaged and killed two hostile Paiute Indians in an action fought in the mountains southwest of Camp Cady, California. Post surgeon, Jonathan Letterman, reported that "in the affray two men were seriously wounded, one in the neck and one in the abdomen, by the Indians. Both are doing well, but the one wounded in the abdomen is not out of danger yet." Located in the desolate Mojave Desert, and described as a place where "four officers and a handful of men manage to exist in some unexplained way in mud and brush hovels," Camp Cady was regarded as the worst post in the Army. **(1860)**

6 Jun — Captain David Thomas, battalion surgeon, 508th Parachute Infantry Regiment, recalled treating his first casualty on the day after his night jump into Normandy: "I had one patient, a trooper in a ditch with his leg almost blown off, except for his patellar tendon. I had . . . no way to anesthetize him. I said 'Son, it's like the days in the Wild West. You're going to have to bite the bullet and I am going to have to separate the leg.' I cut the patellar tendon and put a dressing on it. He never whimpered." **(1944)**

15 Jun — Marshal Blucher led the Prussian Army in a bloody fight with Napoleon's forces at Ligny, Belgium, in a prelude to the Anglo-Prussian victory at Waterloo. An alcoholic, but still physically vigorous in his 70s, Blucher also had psychiatric problems and fought both battles while suffering from the delusion that he was pregnant with a baby elephant. **(1815)**

18 Jun — In the aftermath of the Battle of Bunker Hill, the 271 American wounded were transported to Cambridge, MA, where two private homes were utilized as hospitals under the direction of eight volunteer physicians. **(1775)**

At the Battle of Waterloo, a French canister pellet shattered the right knee of Lord Uxbridge, the British cavalry commander. Forced to undergo amputation of the limb without benefit of an anesthetic, Uxbridge's only complaint was that "those knives appear somewhat blunt." He survived shock, blood loss, and post-operative infection to live another 39 years. Another British officer, who lost his left arm to amputation on the same day, directed a medical orderly to retrieve his severed limb so that he could personally remove his wedding ring from his lifeless finger. **(1815)**

19 Jun — Doctor Ronald Stewart, Trauma Director of University Hospital, San Antonio, TX, reported that a survey of 95 snakebite victims treated at the hospital's emergency room between 1997 and 2001 revealed that about half of the bites were received by people who were teasing or "playing" with venomous snakes, and that "a good percentage of those were intoxicated men." **(2002)**

23 Jun — The Tullahoma Campaign opened in central Tennessee as Union MG William S. Rosecrans began a skillful scheme of maneuver which would force Confederate LTG Braxton Bragg completely out of Tennessee within 11 days without fighting a major battle. When experiencing marked emotional stress, the dyspeptic Bragg often reacted by developing a severe case of boils on his buttocks, which impeded both his personal mobility on horseback and his ability to plan and concentrate due to the incessant pain. **(1863)**

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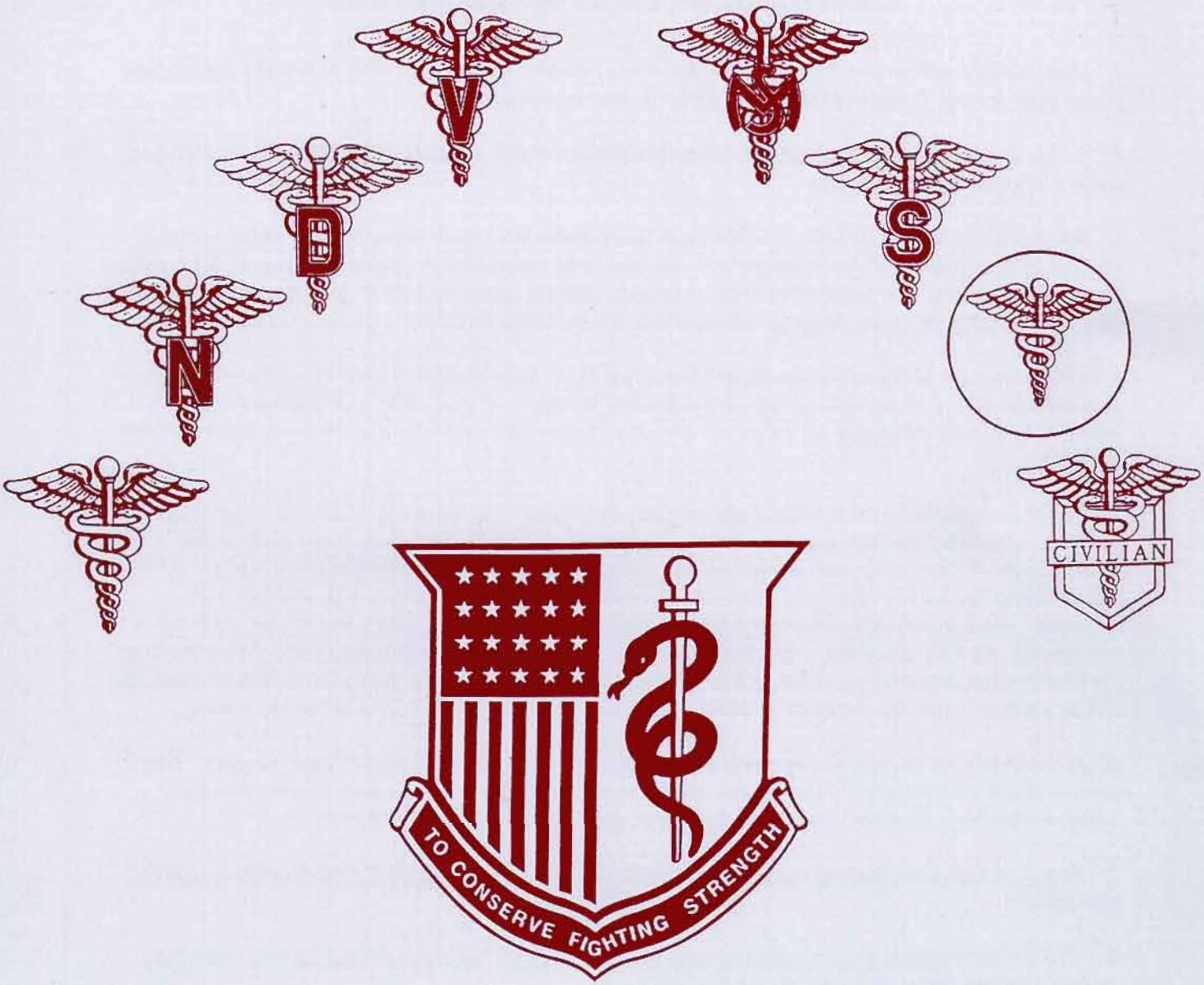

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